

BELL LABORATORIES RECORD

INDEX

Volume 33
January 1955 to December 1955

Bell Laboratories Record

Editor
JULIAN D. TEBO

Associate Editor
W. D. BULLOCH

Assistant Editor
GEORGE E. SCHINDLER, JR.

Assistant Editor
R. C. SANFORD

Production Editor
R. LINSLEY SHEPHERD

Circulation Manager
THEODORE N. POPE

BELL TELEPHONE LABORATORIES, INCORPORATED
463 West Street, New York 14, N. Y.

LIST OF ISSUES IN VOLUME 33

No.	1	January	Pages	1- 40
"	2	February		41- 80
"	3	March		81-120
"	4	April		121-160
"	5	May		161-200
"	6	June		201-240
"	7	July		241-280
"	8	August		281-320
"	9	September		321-360
"	10	October		361-400
"	11	November		401-440
"	12	December		441-480

Index to Authors, Subjects and Titles, Volume 33

A

- A.I.E.E. *See* American Institute of Electrical Engineers
 AN/TCC-3 CABLE TERMINAL *See* Terminal
 AN/TCC-7 CABLE TERMINAL *See* Terminal
 AN/TRC-24 ANTENNA *See* Antenna
 AN/TRC-24 RADIO SET *See* Radio Set
 AN/TRC-24 RADIO TRANSMITTER *See* Transmitter
 A.S.M.E. *See* American Society of Mechanical Engineers
 A.S.T.M. *See* American Society for Testing Materials
 A.T.&T. *See* American Telephone and Telegraph Company
Absolutely Monotone Functions (B. McMillan) 34 (referred to)
 ABSORPTION
 ultrasonic
 (in) fused silica 240
 ACCOUNTING *See* Automatic Message Accounting
 Achenbach, C. H.
 Power Equipment for Telephone Central Offices 280 (referred to)
 ACOUSTICS
 microphones, calibration, early 10
 standard
 microphone, condenser, W.E. 640 AA 6-10
Adjustable Equalizers for the L3 Coaxial System (R. S. Graham, J. P. Kinser) 468-71
 ADMITTANCE BRIDGE *See* Bridge
Adsorption of Gases and Vapors on Germanium (E. E. Francois, J. T. Law) 439 (referred to)
Adsorption of Gases on a Germanium Surface (J. T. Law) 330 (referred to)
Adsorption of Strontium and of Barium on Tungsten (H. W. Allison, G. E. Moore) 480 (referred to)
Adsorption of Water Vapor on Germanium and Germanium Dioxide (J. T. Law) 120 (referred to)
 AERIAL CABLE *See* Cable
 Affel, H. A.
 Laboratories Fellowships committee 465
Aging of the Properties of Barium Titanate and Related Ferroelectric Ceramics (W. P. Mason) 134 (referred to)
 AIR FORCE *See* United States Air Force
 AIR TRAFFIC
 control 400
 ALASKA TELEPHONE CABLE
 landing sites, selection 358
 ALFRED P. SLOAN FOUNDATION
 M. J. Kelly, trustee 235
 Alfredo, E. J., Jr *illus* 416
 ALGEBRA, switching *See* Boolean Algebra
 Allison, H. W.
 Adsorption of Strontium and of Barium on Tungsten 480 (referred to)
 Allen, I. J.
 Audio-Frequency Circuit Model of the 1-Dimensional Schroedinger Equation and Its Sources of Error 439 (referred to)
 ALLOTTER
 PBX
 crossbar systems, 5-type 352-54
 pictorial representation 353
 ALLOY(s)
 germanium-gallium
 constitution 119
 germanium silicon
 (in) semiconductor devices 120
 lead-silver
 transition structure 240
 See also Alnico 5
 Almquist, M. L.
 Director of Systems Engineering I 277
 ALNICO 5
 cooling, effect 405-09
 crystal, *see* Crystal
 heat, effect 405-09
 inner structure 405-09
 magnetic powder pattern *illus* 408
 magnetization 405-09
 diagram 406
 physical characteristics 405-09
 ALPHA QUARTZ *See* Quartz
 ALTERNATE ROUTING *See* Routing
 ALTERNATOR
 coaxial carrier, L3 power supply *illus* 221
 ALUMINUM
 die castings 439
 extrusion, experimental
 (for) cable sheath 240
 See also Alnico 5
Aluminum Die Castings for Carrier Telephone Systems (L. Pedersen) 439 (referred to)
 ALUMINUM FERRITE *See* Ferrite
 AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS
 Edison Medal, 1954
 Buckley, Oliver E., recipient 15
 Laboratories members, active, 1955-56 431
 Laboratories members named to Executive Committees 477
 AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS
 Mathewson Gold Medal awarded to W. G. Pfann 38
 AMERICAN PHYSICAL SOCIETY
 Baltimore meeting
 talks, by members of the Laboratories 199
 AMERICAN SOCIETY FOR TESTING MATERIALS
 pole research, with Bell System and United States Forest Products Laboratory 98-99
 AMERICAN SOCIETY OF MECHANICAL ENGINEERS
 Holley Medal, awarded to Walter A. Shewart 117
 AMERICAN TELEPHONE AND TELEGRAPH COMPANY
 Alaska Telephone Cable
 landing sites, selection 358
 annual report, 1954, highlights 114-15
 Hawaiian telephone cable, projected 358-59
 Long Lines department, *see* Long Lines Department
 share owners' meeting, 1955 236-37
 AMERICUS, GEORGIA
 P1 carrier telephone system, experimental service 434
 solar battery, experimental service 166, 398, 434
 AMPLIFIER
 bridging
 program switching 415-18

AMPLIFIER

AMPLIFIER, continued

- dielectric
 - ferroelectrics in 34
- microwave beam
 - noise figure, minimum 400
- 151A, in telephone set, 532-type 361-63
- simplified schematic 363
- transistor, 149A *illus* 180
- transistor, field-effect
 - schematic diagram 172
- transistor, miniature 247-50; *illus* 248
 - characteristics 247-48
 - electrical circuit
 - schematic diagram 250
 - manufacture 248-50
- traveling-wave
 - large-signal theory 198, 280, 439
- ANALYSIS, thermal *See* Thermal Analysis
- Analysis of No. 5 Crossbar Trouble Recorder Cards (G. H. Duhnkrack) 206-10
- Analysis of the Single Tapered Mode Coupler (W. H. Louisell) 320 (referred to)
- Anderson, F. W. *illus* 344
- Anderson, I. V. *illus* 98
- Anderson, J. Reid *illus* 335, 341
 - biographical material 341
 - Ferroelectric Storage Devices 335-42
- Anderson, O. L.
 - Calculation of the Activation Energy of Ionic Conductivity in Silica Glasses by Classical Methods 71 (referred to)
 - Ultrasonic Absorption in Fused Silica at Low Temperatures and High Frequencies, 240 (referred to)
- Anderson, P. W.
 - Ferromagnetic Resonance in Ferroxdure 320 (referred to)
- Anderson, R. E. D.
 - Magnetically Regulated Portable Battery Charger 119 (referred to)
- Andres, R. R. *illus* 293
- ANISOTROPY
 - ferrites 480
 - magnetocrystalline
 - frequency dependence 480
- Anisotropy and Magnetostriction of Some Ferrites (R. M. Bozorth, E. F. Tilden, A. J. Williams) 480 (referred to)
- ANNOUNCEMENT SYSTEM
 - 6A
 - block diagram 332
 - intercepting service 331-34
- ANODE FILM
 - formation, at high fields, theory 134
- ANTENNA
 - horn reflector, broadband 401-04; *illus* frontcover Nov, 403
 - applications, Bell System 437
 - geometry 402
 - radiated energy, graph 403
 - microwave
 - horn reflector, broadband 401-54
 - radio set, AN/TRC-24 466-67; *illus* 275, 291
- ANTENNA ARRAYS
 - random variations, subject to design, optimum 240
- ANTI-AIRCRAFT MISSILE *See* Nike
- ANTIMONIDE(S)
 - group III
 - work, recent 134
- AN/TRC-24 Radio Transmitter (W. G. Hensel, C. G. Reinschmidt) 428-31

APPARATUS

- assembly problems 81
- miniaturization, in plastic 81-84
- Apparatus for Measuring the Elastic Moduli and Internal Friction of Solids from 1.7 to above 77 K and Some Values for α -Quartz (M. E. Fine) 119 (referred to)
- Application of the Wiedemann Effect to the Magnetostrictive Coupling of Crossed Coils (U. F. Gianola) 439 (referred to)
- Arcing at Electrical Contacts on Closure. Part VI—The Anode Mechanism of Extremely Short Arcs (W. S. Boyle, L. H. Germer) 280 (referred to)
- Arcing of Electrical Contact in Telephone Switching Systems. Part IV—Mechanism of the Initiation of the Short Arc (M. M. Atalla) 71 (referred to)
- Argerie, S. J. *illus* 256, 258
- Armfield, Harold *illus* 98
- Arnold, C. G. *illus* 182, 183, 186
 - biographical material 186
 - Repeaters in the L3 Coaxial Carrier System 182-87
- Arnold, W. O.
 - System Plan for Air Traffic Control Embodying the Cussor-Coordinated Display 400 (referred to)
- ARSENIDE(S)
 - group III
 - work, recent 134
- Atalla, M. M.
 - Arcing of Electrical Contacts in Telephone Switching Systems. Part IV—Mechanism of the Initiation of the Short Arc 71 (referred to)
 - Theory of Open-Contact Performance of Twin Contacts 34 (referred to)
- Atkins, G. E. *illus* 135
 - New High-Speed Recording System 135-36
- ATLANTA, GEORGIA
 - outside plant urban wire test *illus* 252
- ATOM(S)
 - adsorbed
 - life history 439
- ATOMS FOR PEACE AWARDS
 - committee personnel 418
 - Kelly, M. J., committee membership 418
- ATTENUATION
 - lead, single crystal, at low temperatures 330
 - ultrasonic
 - (in) lead, normal conducting 134
- AUDICHRON COMPANY
 - time bureaus, magnetic announcements 364
- Audio-Frequency Circuit Model of the 1-Dimensional Schroedinger Equation and Its Sources of Error (L. J. Allen, J. H. Blackwell, R. S. Cass, D. R. Fewer) 439 (referred to)
- Automatic Alternate Routing in the 4A Crossbar System (E. Jacobitti) 141-45
- AUTOMATIC CHANNEL SWITCHING *See* Switching
- AUTOMATIC MESSAGE ACCOUNTING 330
 - centralized 34
 - billing indexer 267-70
 - controller circuit
 - block diagram 194
 - crossbar tandem PCI sender 223-26
 - link circuit 193-96
 - role, block diagram 194
 - sender test circuit 313-16
 - block schematic 315
 - functions 313-14
 - transverter 267-70
 - digit register, wiring diagram 356
 - relays, sealed switch 355-57

- Automatic Private-Line Teletypewriter Switching System*
G. A. Locks, (E. R. Robinson) 321-26
Automatic Relay-Adjusting Circuit (J. T. L. Brown) 60-64
AUXILIARY REPEATER *See* Repeater
Avalanche Breakdown in Germanium (S. L. Miller) 439
(referred to)

B

- Babcock, W. C.
Radio Set AN/TRC-24: Antenna 466-67
Bagley, N. H. *illus* 370
Baker, William O. *illus* 436
biographical material 436
Formation and Properties of Polymer Carbon 320, 480
(referred to)
Laboratories Vice President 436
Odd Electrons in Polymer Molecules 480 (referred to)
BALANCE
micro-
spring-type 50-53
spring
accuracy 51
BALLANTINE MEDAL
Shannon, C. E., award 436-37
Bardeen, John *illus* 187
honorary degree, Union College 318
Scott, John, Medal, award 187
BARIUM
evaporation, from oxide-coated cathode 134
excess, in oxide coated cathodes 400
tungsten, adsorption on 480
Barium Getters in Carbon Monoxide (J. Morrison, R. B. Zetterstrom) 280 (referred to)
BARIUM TITANATE
aging 134
BARIUM TITANATE CRYSTAL *See* Crystal
Barrett, W. G. *illus* 126
Barstow, J. M.
Color TV—How It Works 480 (referred to)
BARTER ISLAND, Alaska
Distant Early Warning Line station *illus* 158
Basseches, H.
Gassing of Liquid Dielectrics under Electrical Stress 439
(referred to)
BATTERY, solar *See* Solar Battery
BATTERY, storage *See* Storage Battery
BATTERY CHARGER *See* Charger
BEAM AMPLIFIER, microwave *See* Amplifier
Beck, A. C.
I.R.E. Professional Group chairman 476
Measurement Techniques for Multimode Waveguides
280, 480 (referred to)
Becker, Joseph A. *illus* 1, 5
biographical material 5
Life History of Adsorbed Atoms, Ions, and Molecules
439 (referred to)
*On the Adsorption of Oxygen on Tungsten as Revealed
in the Field Emission Electron Microscope* 330 (re-
ferred to)
Ultra-High Vacua 1-5
*Behavior and Applications of Ferrites in the Microwave
Region* (A. G. Fox, S. E. Miller, M. T. Weiss) 71
(referred to)
Behavior of Ferroxdure at Microwave Frequencies (M. T.
Weiss) 330 (referred to)
BELL SOLAR BATTERY *See* Solar Battery
Bell Solar Battery (D. M. Chapin, C. S. Fuller, G. L.
Pearson) 241-46
BELL SYSTEM
advances, 1954
cable, aerial
statistics 161
National Safety Council, highest award, receipt 212
operating companies, *see* Operating Companies; also
names of particular operating companies, i.e., Ches-
apeake and Potomac Telephone Company
outside plant, *see* Outside Plant
Bell System Participation in ASTM Pole Research (O. A.
Hanna) 98-99
BELL SYSTEM PRACTICES
O-type carrier, testing
instructions, improved 299-302
diagram 300-01
BELL SYSTEM TECHNICAL JOURNAL
Editorial Committee, new members 371
BELL TELEPHONE LABORATORIES
Board of Directors, listed 475
current work 330
Bemski, G.
*Cosine Interaction in Cesium Fluoride and Rubidium
Fluoride* 280 (referred to)
Benes, V. E.
On the Consistency of an Axiom of Enumerability 280
(referred to)
Partial Model for Quine's "New Foundations" 34 (re-
ferred to)
Bennett, W. R.
*Interchannel Interference in FM and PM Systems under
Noise Loading Conditions* 240 (referred to)
I.R.E. Fellow 473
I.R.E. Technical Committee chairman 477
Bertels, A. R. *illus* 331, 334
biographical material 334
Intercepting with Recorded Announcements 331-34
Best, F. S.
Coaxial Electrical Connection into Vacuum 280 (re-
ferred to)
BILLING
toll calls, special
teletypewriter 232-34
BILLING INDEXER
automatic message accounting centralized 267-70
block diagrams 268, 269
Bingert, F. W. *illus* 115
Biondi, F. J.
Chemist's Role in Electronics 330 (referred to)
Bischoff, C. F. *illus* 127
Black, Harold S.
honorary degree, Worcester Polytechnic Institute 318
Blackwell, J. H.
*Audio-Frequency Circuit Model of the 1-Dimensional
Schroedinger Equation and Its Sources of Error* 439
(referred to)
Blye, P. W.
Director of Systems Engineering II 277
Revised Telephone Transmission Rating Plan 240 (re-
ferred to)
Bogert, B. P.
Some Gyrator and Impedance Inverter Circuits 330 (re-
ferred to)
*Stereophonic Sound Reproduction Enhancement Utiliz-
ing the Haas Effect* 320 (referred to)
Bommel, H. E.
*Ultrasonic Absorption in Fused Silica at Low Tempera-
tures and High Frequencies* 240 (referred to)
Bonner, Arthur L. *illus* 264, 266
biographical material 266
Servicing Center for Short-Haul Carrier 264-66

Bonnesen, E. J. *illus* 253

BOOLEAN ALGEBRA

matrices: circuits, combinational relay, design 71

Boolean Matrices and the Design of Combinational Relay Switching Circuits (F. E. Hohn, L. R. Schissler) 71 (referred to)

Boorse, H. A.

Helium II Film Transport. I. The Role of Substrate 280 (referred to)

Helium II Film Transport. II. The Role of Surface Finish 439 (referred to)

Helium II Film Transport. III. The Role of Film Height 400 (referred to)

Helium II Film Transport. IV. The Role of Temperature 439 (referred to)

Borges, J. N. *illus* 261

BORON

(in) silicon, determination 330

silicon, diffusion into 34

See also Dimethylamine-Boron-Trifluoride

Bouton, G. M.

Experimental Extrusion of Aluminum Cable Sheath at Bell Telephone Laboratories 240 (referred to)

Bower, Frank H.

Manufacturing Grown Junction Transistors 71

Bown, R.

Transistor as an Industrial Research Episode 119 (referred to)

Government-Industry Research Committee 38

solar energy symposium 476

Boyle, W. S.

Arcing at Electrical Contacts on Closure. Part VI—The Anode Mechanism of Extremely Short Arcs 280 (referred to)

Departure from Paschen's Law in Breakdown of Gases 134 (referred to)

Electrical Breakdown in High Vacuum 320 (referred to)

Self-Propagating Intermittent Discharge 280 (referred to)

Bozorth, R. M.

Anisotropy and Magnetostriction of Some Ferrites 480 (referred to)

Frequency Dependence of Magnetocrystalline Anisotropy 480 (referred to)

Bracken, Stanley *illus* 159

biographical material 159

retirement as Western Electric Board chairman 159

Sigma Tau Distinguished Service Award 159

BRACKET

drop 45; *illus* 46

point type 45; *illus* 46

tandem *illus* 47

Brandes, R. G. *illus* 3

On the Adsorption of Oxygen on Tungsten as Revealed in the Field Emission Electron Microscope 330 (referred to)

vacua, ultra-high, development 4

Brass Plating (G. Bittrich, K. G. Compton, R. A. Ehrhardt) 280 (referred to)

Brattain, Walter H. *illus* 187

Experiments on the Interface between Germanium and an Electrolyte 71 (referred to)

honorary degrees

Union College 318

Whitman College 318

Physical Theory of Semiconductor Surfaces 400 (referred to)

Scott, John, Medal, award 187

Surface Properties of Semiconductors 134 (referred to)

BREAKDOWN

electrical, in high vacuum 320

Breidt, P., Jr.

Melting Joint of Germanium and the Constitution of Some Germanium-Gallium Alloys 119 (referred to)

Brewer, S. T.

Telephone Switching Network and Its Electronic Control 134 (referred to)

BRIDGE

admittance, 30-mc, precision 21-24

Schering-type

equations 23

Wheatstone

equations 21-22

Bridgers, Henry E. *illus* 41, 44, 123

biographical material 44

Rate-Grown Germanium Crystals for High Frequency Transistors 439 (referred to)

Single-Crystal Germanium 41-44

BRIDGING AMPLIFIER See Amplifier

BRILLOUIN FLOW

generalizations 320

Broadband Horn Reflector Antenna (A. T. Corbin, A. S. May) 401-04

Broadband Test Oscillator for the L3 Coaxial Carrier System (J. O. Israel) 271-73

BROMINE

See also Cyanogen Bromide

Brown, J. T. Lindsay *illus* 60, 64

biographical material 64

Automatic Relay-Adjusting Circuit 60-64

Brown, S. C.

High-Frequency Gas Discharge Plasma in Hydrogen 280 (referred to)

Brymer, S. J. *illus* 192

biographical material 192

Converting Toll Offices for Nationwide Dialing 188-92

Buckley, Oliver E.

Edison Medal 1954, awarded by A.I.E.E. 15

BUCKLEY GAUGE 3

Budenbom, H. T.

I.R.E. Fellow 473

Buehler, E.

Resistivity Changes in Silicon Single Crystals Induced by Heat Treatment 240 (referred to)

Silicon n-p-n Grown Junction Transistors 320 (referred to)

Bullington, Kenneth

Characteristics of Beyond-the-Horizon Radio Transmission 480 (referred to)

I.R.E. Fellow 38

Morris Liebmann Prize, I.R.E., award 399

Results of Propagation Tests at 505 Mc and 4,090 Mc on Beyond-Horizon Paths 480 (referred to)

Burgess, M. S. *illus* 51, 53

biographical material 53

Spring-Type Micro-Balance 50-53

Burke, P. J. *illus* 125

Burns, F. P.

Ordering Processes in Copper Auride 280 (referred to)

Burns, R. M.

Crisis in Science Teaching 34 (referred to)

Burton, J. A.

Impurity Centers in Germanium and Silicon 134 (referred to)

Byrnes, P. A. *illus* 312

C

CAMA See Automatic Message Accounting: centralized

CABLE(S)

aerial

lashing, conventional 163-64; *illus* 162

lashing, introduction 162

prelashing 161-65

apparatus *illus* 161

schematic diagram 162

hangers *illus* 163-65

Alaskan, see Alaska Telephone Cable

coaxial

phase shift, measurement 350-51

shields, solderless connection 472-73; *illus*

equalization

L3 coaxial carrier 390-93

television transmission, local 320

(to) Hawaii, see Hawaiian Telephone Cable

sheath

aluminum, extrusion, experimental 240

shields

connectors for 58-59

solderless connection 472-73; *illus*

splice closures, mechanical 400

spiral four 291

transatlantic, see Transatlantic Telephone Cable

wiring

tool, combinational

operations, sequence *illus* 282

CABLE TERMINAL See Terminal

Cabrey, R. L. *illus* 122

Calbick, C. J.

Ice 34 (referred to)

Surface Studies with the Electron Microscope 439 (referred to)

CALCIUM 48

decay, double beta, search 240

Calculation of the Activation Energy of Ionic Conductivity in Silica Glasses by Classical Methods (O. L. Anderson, D. A. Stuart) 71 (referred to)

CALL(S)

toll

special

billing, teletypewriter 232-34

Callaway, Joseph

Orthogonalized Plane Wave Method 198 (referred to)

Cama-Crossbar Tandem PCI Sender (L. A. Weber) 223-26

Cama-Position Link Frame (C. E. Germanton) 193-96

Cama-Sender Test Circuit (R. Y. Sims) 313-16

Cama: Transverter and Billing Indexer (R. P. Foltz, G. F. Sohnle) 267-70

Campbell, Mary E.

Photometric Determination of Magnesium in Electronic Nickel 34 (referred to)

CAPACITOR

described 441

functions 441

lacquer-film

miniature, metallized 34, 441-44; *illus* 443

applications, Bell System 442-44

manufacture 442-43; *illus*

CARBON

polymer

formation, 320, 480

properties 320, 480

CARBON MONOXIDE

barium getters in 280

electron impact experiments 330

CARBON STEEL See Steel

CARD

translator, crossbar system 4A *illus* 296

coding 295

function 295

trouble recorder

crossbar system, number 5 *illus* 207

analysis 206-10

Card Translator Equipment (R. S. Skinner) 178-81

Carey, G. P. *illus* 312

CARRIER(S)

L3, coaxial

corona effect 146-48

equalization 390-93, 468-71

high-voltage problems 146-48

networks, transmission 21

oscillator, test 271-73

block diagram 272

power supply 220-22

repeaters 182-87

typical arrangement 183

terminals 72-77

military, new

equipment features 34

N-type

servicing center 264-66

O-type

arrangements, possible *illus* 27, 28channels *illus* 25

circuits, group 25-29

design 25-29

filters 137-40

Miniplas assembly *illus* 81

open-wire line applications 46

repeaters 25-29

terminal alarm circuits 109-12

block diagram 110

testing instructions, improved 299-302

ON-type

servicing center 264-66

P1

experimental service 434

short-haul

servicing center 264-66

Carrier Terminals for the L3 System (D. B. Penick) 72-77

Caruso, A. P. *illus* 152

Cass, R. S.

Audio-Frequency Circuit Model of the 1-Dimensional Schroedinger Equation and Its Sources of Error 439 (referred to)

CASTINGS, die

aluminum 439

CATHODE

hollow

emission 439

oxide coated

barium, excess 400

surface flatness, measurement 330

Cathode Interference Impedance Desimplified (H. B. Frost) 280 (referred to)

CELL

solar 242; *illus*

solar, silicon 280

CELL, photoelectric See Phototransistor

CENTRAL OFFICE

magnetic drum

control features 280

power equipment 280

CENTRALIZED AUTOMATIC MESSAGE ACCOUNTING

See Automatic Message Accounting

CENTRALIZED

- Centralized Automatic Message Accounting System* (G. V. King) 34 (referred to)
- CERAMIC(s)
ferroelectric
aging 134
precision 369-71
applications, Bell System 369-71
- CESIUM FLUORIDE
cosine interaction 280
- Cetlin, B. B.
Crystal Structure of Rhodium Selenide 320 (referred to)
- CHANNEL CIRCUIT *See* Circuit
- Chapanis, A.
Effect on Performance of Tilting the Toll-Operator's Key-set 120, 198 (referred to)
- Chapin, Daryl M. *illus* 242, 246
Bell Solar Battery 241-46
biographical material 246
solar battery, invention 166
solar energy symposium 476
- Characteristics of Beyond-the-Horizon Radio Transmission* (K. Bullington) 480 (referred to)
- CHARGER
battery
magnetically regulated, portable 119
- CHARGING
storage batteries 459
- CHARLOTTE, NORTH CAROLINA
4A switching system, installation 29
- Chase, A. J. *illus* 362, 363
biographical material 363
New Volume Control Telephone 361-63
- Chase, F. Harold *illus* 344, 349
biographical material 349
Junction Transistors and Diodes for Power Regulation 344-49
- Chemist's Role in Electronics* (F. J. Biondi) 330 (referred to)
- CHESAPEAKE AND POTOMAC TELEPHONE COMPANY
outside plant rural line test *illus* 251
- CHRISTOPHER COLUMBUS INTERNATIONAL COMMUNICATION PRIZE *illus* 432
Kelly, M. J., award 432-33
Radley, Sir Gordon, award 432-33
- Ciccolella, D. F. *illus* 166, 374
solar battery, further development 166
- CIRCUIT(s)
bridge
admittance, precision 24
Schering-type 23
Wheatstone 22
channel
crossbar system, 4A
simplified schematic 217
connector
Bell System applications 65
coupled, crosstalk 46
drawing
detached-contact, improved 400
electronic, in telegraph serviceboard 198
frequency standards, using overtone crystals 280
group
O-type carrier 25-29
gyrator 330
hub
serviceboard, telegraph, no. 2 424-27
impedance inverter 330
lifetime measurements, semiconductors representation 311
logic
engineering 439
matrix, information storage
diagram 342
microwave
isolator, ferrite 385-89
pulse, nonsaturating, using two junction transistors 330
relay-adjusting, automatic 60-64
block diagram 62
resonant
vowel synthesis with 480
sender test, CAMA 313-16
serviceboard, telegraph, no. 2 424-27
switching
combinational relay
design
Boolean matrices in 71
information storage 335-42
telegraph 11-12
design 15
root mean square or deviation value 14
terminal alarm
O-type carrier 109-12
schematic diagram 110
transmission
active components 419
passive components 419
wave
charges, moving, interaction 280
Circuit Features of the No. 2 Telegraph Serviceboard (J. R. Davey) 424-27
- Cirone, Frank P. *illus* 414
biographical material 414
Code Conversion in No. 5 Crossbar 410-14
- CLAMP
drop wire *illus* 70
testing machine 70-71
- Clark, Alva B. *illus* 474
biographical material 474
I.R.E. Fellow 473
obituary 474
- Clarke, K. B.
Making Small Parts 71 (referred to)
- Clayden, F. W.
Improvements in Wiper Springs for Step-by-Step Switches 372-73
- Clogston, A. M.
Relaxation Phenomena in Ferrites 320 (referred to)
- Clos, C. *illus* 297
- COAXIAL CABLE *See* Cable
- COAXIAL CARRIER SYSTEM, L3 *See* Carrier
- COAXIAL CONNECTION *See* Connection
- Coaxial Electrical Connection into Vacuum* (F. S. Best, G. A. Harrower, A. A. Machalett) 280 (referred to)
- Coaxial Patch Plugs for TD-2 Radio* (R. Morse) 450
- COBALT SILICIDE CRYSTAL *See* Crystal
- Code Conversion in No. 5 Crossbar* (F. P. Cirone) 410-14
- COIL(s)
crossed
coupling, magnetostrictive 439
Cokhead, H. B. *illus* 11
- Collins, R. W. *illus* 368
biographical material 368
Emergency Radio Telephone System 365-68
Color TV—How It Works (J. M. Barstow) 480 (referred to)
Combination Wire-Wrapping Tool (R. F. Mallina, F. Reck) 281-84
- Combs, Frederick B. *illus* 368
biographical material 368
Emergency Radio Telephone System 365-68

- COMMUNICATION NETWORK, military *See* Network
- COMMUNICATIONS MEDIA
waveguide as 34
- COMPONENT(s)
assembly problems 81
miniaturization, in plastic 81-84
portable, grounding 240
small
fabrication 71
- Compton, K. G.
Brass Plating 280 (referred to)
- COMPUTER
transistor
(for) U. S. Air Force 155-56
- COMPUTING MACHINES
personnel, training for 280
- Condenser Microphone as an Acoustic Standard* (M. S. Hawley) 6-10
- CONDUCTIVITY
ionic
glasses, silica
activation energy, calculation 71
germanium, research study 90-92
See also Superconductivity
- CONDUCTOR
electronic 85-89
- CONNECTION
coaxial, into vacuum 280
solderless
coaxial cable 472-73; *illus*
solderless wrapped *illus* frontcover Aug
combinational tools, use of 281-84
introduction 281
- CONNECTOR
GSF 327 *illus* 59
GSF 405 *illus* 58
shielding
flag-type 59
- Connectors for Cable Shields* (F. W. Koller) 58-59
- Connectors in 4A Toll Crossbar* (M. E. Esternaux) 65-69
- Connick, W. F. *illus* 381
- CONSOLIDATED FREIGHTWAYS
teletypewriter relay system, automatic 438
- CONTACT(s)
arcing
arc, short, initiation 71
arcing, on closure
arc, short, anode mechanism 280
diodes 260-63
fast-recombination 261; *illus*
applications, Bell System *illus* 262
non-injecting 261-62; *illus* 261
applications, Bell System *illus* 262
relay
erosion
determination, micro-balance 50-53
transistors 260-63
twin
open-contact performance, theory 34
- Continuous Multistage Separation by Zone-Melting* (W. G. Pfana) 280 (referred to)
- Control Features of Magnetic-Drum Telephone Office* (W. A. Malthaner, H. E. Vaughan) 280 (referred to)
- CONTROL TERMINAL
radio, military 263
- Converting Toll Offices for Nationwide Dialing* (S. J. Brymer) 188-92
- Cook, J. S.
Tapered Velocity Couplers 320 (referred to)
- Cook, Morris *illus* 159, 364
- Coolidge, O. H.
Revised Telephone Transmission Rating Plan 240 (referred to)
- Coons, R. W. *illus* 22
- Cooper, H. G.
Irradiation Effects in Copper, Silver, and Gold near 10°K 198 (referred to)
- Cooper, Jean M. *illus* 321
- COPPER
irradiation effects near 10°K 198
- COPPER AURIDE
ordering processes 280
- Corbin, A. T. *illus* 403, 404
biographical material 404
Broadband Horn Reflector Antenna 401-04
- CORD
patch, solderless connection 472-73; *illus*
- CORONA EFFECT
coaxial carrier, L3 146-48
- Cory, Samuel I. *illus* 11, 14
biographical material 14
Telegraph Transmission Coefficients 11-15
- Cosine Interaction in Cesium Fluoride and Rubidium Fluoride* (G. Bemski, W. A. Nirenberg, H. B. Silsbee) 280 (referred to)
- COUPLER
fineline, ultra-bandwidth 320
single tapered mode
analysis 320
tapered velocity 320
- COUPLING UNIT
electronic, 144A1
schematic diagram 425
serviceboard, telegraph, no. 2 424-27
- Courage, J. W.
Making Small Parts 71 (referred to)
- Cousins, Sanford B. *illus* 116
A.T.&T. Vice President in charge of Public Relations 116
biographical material 116
- Cox, Miss R. E.
Theory of Open-Contact Performance of Twin Contacts 34 (referred to)
- Cozine, J. J. *illus* 397
biographical material 397
"Two-Train" Switching in Toll Crossbar Offices 394-97
- Craig, Cleo F. *illus* 237
A.T.&T. share owners' meeting, address 236-37
Wharton School Alumni Society Medal, award 475
- Creosote Retention as Determined by Toluene Extraction of Treated Wood* (A. H. Hearn) 240 (referred to)
- Crisis in Science Teaching* (R. M. Burns) 34 (referred to)
- Cronburg, C.I.L., Jr. *illus* 299, 302
biographical material 302
Improved Testing Instructions for Type-O Carrier 299-302
- CROSSBAR SYSTEMS
4A toll
automatic alternate routing 141-45
card translator 93-97, 178
channel circuit
simplified schematic 217
connectors in 65-69
index channels
current, output, measurement *illus* 218
Long Lines Department, conversion 29
traffic load control 256-59
block diagram 257
traffic registration 149-51
transistors in 215-19
translator card 294-98

CROSSBAR

CROSSBAR SYSTEMS, continued

- "two-train" switching 394-97
- 5-type
 - code conversion 410-14
 - simplified diagram 413
 - foreign area translation 54-57
 - functions 410
 - intertoll features 30-33
 - overload control 379-81
 - PBX allotter 352-54
 - pictorial representation 353
 - switching paths, diagram 33
 - trouble diagnosis 206-10
 - versatility 410
- recording system, high speed 135-36
- toll
 - traffic load control 256-59
- See also Switching Systems
- CROSSTALK
 - open-wire lines 45
- Cruser, V. I.
 - Equipment and Mechanical Features of the AN/TRC-24 Radio Set* 34 (referred to)
- CRYSTAL(s)
 - Alnico 5
 - torque curves 407
 - barium titanate
 - domains, antiparallel *illus* 337
 - etch patterns 280
 - ferroelectric domains 280
 - information storage 335-42
 - storage arrangement, two-dimensional *illus* front-cover Sep
 - schematic drawing 340
 - cobalt
 - elastic constants, measurement 280
 - cobalt silicide, structure 198
 - deformation, plastic 285-89
 - development 41
 - dislocations 104-05
 - ferroelectric
 - hysteresis loop, diagram 336
 - information storage 335-42
 - germanium
 - dislocations in 104-07
 - growing 41-44
 - ratc-grown 439
 - growth, machine
 - schematic diagram 42
 - lattices 104-05
 - lead
 - attenuation, relaxation, at low temperatures 330
 - lifetime measurements 308-12
 - overtone
 - circuit, frequency standard 280
 - purification
 - zone-melting 201-05
 - resistivity measurements 308-12
 - rhodium selenide, structure 320
 - rhodium telluride, structure 280
 - shear-stress relation, table 286
 - silicon
 - band structure 134
 - magneto-resistance effect 134
 - resistivity changes, heat-induced 240
 - single
 - growth
 - procedure 42-44
 - slip 285-89

slipped

atoms, schematic arrangement 287

stress-strain curve 287

unstrained

atoms, schematic arrangement 286

See also Anisotropy

Crystal Structure and Quadrupole Coupling of Cyanogen Bromide, BrCN (S. Geller, A. L. Schawlow) 320 (referred to)

Crystal Structure of Cobalt Silicide (S. Geller, V. M. Wolontis) 198 (referred to)

Crystal Structure of Rhodium Selenide (B. B. Cetlin, S. Geller) 320 (referred to)

Crystal Structure of Rhodium Telluride (S. Geller) 280 (referred to)

CRYSTAL UNITS

plated

high-frequency

aging 330

CUPRIC OXIDE

electron diffraction patterns 400

CURRENT

spurious

vacua, ultra-high 3

Curtis, H. E.

Interchannel Interference in FM and PM Systems under Noise Loading Conditions 240 (referred to)

Cusick, Mrs. Marilyn *illus* 126

Cutler, C. C.

I.R.E. Fellow 38

Pin-Hole Camera Inspection of Electron Beams 198 (referred to)

Regenerative Pulse Generator 134 (referred to)

Thermal Velocity Effects in Electron Guns 198 (referred to)

CYANOGEN BROMIDE

coupling, quadrupole 320

D

DEW See Distant Early Warning Line

Dacey, G. C. *illus* 167

Dahlbom, Carl A. *illus* 307

biographical material 307

New Supervisory Control System 304-07

DALLAS, TEXAS

radio relay route 437

Danielson, W. E.

Minimum Noise Figure of Traveling-Wave Tubes with Uniform Helices 34 (referred to)

DANISH ACADEMY OF TECHNICAL SCIENCES

Valdemar Poulsen Gold Medal awarded to H. T. Friis 38

Darlington, S.

Introduction to Time-Variable Networks 280 (referred to)

Darrow, Karl K. *illus* 98

biographical material 89

Electronic Conductors 85-89

Some Current Work at Bell Telephone Laboratories 330 (referred to)

Davey, J. R. *illus* 424, 426

biographical material 426

Circuit Features of the No. 2 Telegraph Serviceboard 424-27

New Telegraph Serviceboard Using Electronic Circuits 198 (referred to)

Davis, J. L.

Ferromagnetic Resonance in Magnesium-Manganese Aluminum Ferrite between 160 and 1,900 Mc 439 (referred to)

- Davis, W. A. *illus* 196
- DeCoste, J. B.
Weathering of Polyvinyl Chloride Wire and Cable Applications 134 (referred to)
- Definition of Passive Linear Networks in Terms of Time and Energy* (G. Raisbeck) 120 (referred to)
- DEFORMATION
 plastic
 crystals 285-89
- DELAY LINES
 ultrasonic, transducers 240
- Demonstration of Bandwidth Capabilities of Beyond-Horizon Tropospheric Radio Propagation* (W. H. Tidd) 480 (referred to)
- Dempster, R. *illus* 470
- DENVER, COLORADO
 4A switching system, installation 29
- Departure from Paschen's Law in Breakdown of Gases* (W. S. Boyle, P. Kisliuk) 134 (referred to)
- DESIGN
 antenna arrays, subject to random variations 240
 circuits
 telegraph transmission 15
 O-type carrier 25-29
 safety factors 212-14
 servo systems, mechanical 34
 telephone set, 532-type 361
 testing aids
 safety factors 212-14
 transducers
 delay lines, ultrasonic 240
 transistor, germanium, alloyed junction, for high-speed switching 320
 transposition systems 46
- Design Method for the Calculation of Stagewise Reaction Systems* (D. R. Mason) 71 (referred to)
- Design of Alloyed Junction Germanium Transistors for High-Speed Switching* (J. J. Ebers, S. L. Miller) 320 (referred to)
- Determination of Thermodynamic Equilibrium Constants in Mixed Solvents* (W. C. Sernelius, L. G. Van Uitert) 34 (referred to)
- Determination of Traces of Boron in Silicon* (C. L. Luke) 330 (referred to)
- Development of Reed Switches and Relays* (O. M. Hovgaard, G. E. Perreault) 134 (referred to)
- Dewald, J. F.
Theory of the Kinetics of Formation of Anode Films at High Fields 134 (referred to)
- DIAL TELEPHONE, DIALING
 automatic
 5-type crossbar system 30-33
 card translator 178
 carrier systems, *see* Carrier
 central office, *see* Central Office
 dial tone, *see* Dial Tone
 foreign area
 crossbar system, 4A 141-45
 crossbar system, number 5 54-57
 governor 34
 nationwide 330
 automatic message accounting, centralized 267-70
 4A toll crossbar system conversions 188-92
 crossbar systems, 5-type
 code conversion 410-14
 numbering codes 54-55
 radio telephone system, emergency 365-68
 routing, *see* Routing
- set, *see* Telephone Set
 traffic, *see* Traffic
 transmission, *see* Transmission
- DIAL TONE
 speed, studies 126-27
- Dickten, E. *illus* 121, 123
- DIE CASTINGS
 aluminum 439
- DIELECTRIC(s)
 liquid, gassing under stress 439
- DIELECTRIC AMPLIFIER *See* Amplifier
- Dietrich, A. F. *illus* 131
- Dietzold, R. L.
 BSJT Editorial Committee, appointment 371
 I.R.E. Fellow 38
 Laboratories Fellowships committee 465
- Differential Phase and Gain Measurements in Color Television Systems* (H. P. Kelly) 34 (referred to)
- Differential Thermal Analyst* (P. D. Garn) 451-54
- DIFFRACTION
 electron
 cupric oxide 400
- Diffusion of Boron and Phosphorus into Silicon* (C. S. Fuller, J. A. Ditzenger) 34 (referred to)
- DIGITAL INFORMATION *See* Information
- DIMETHYLAMINE-BORON-TRIFLUORIDE
 structure, note on 198
- Dimond, T. L.
Long Distance Dialing and Automatic Accounting 330 (referred to)
- DIODE(s)
 contacts 260-63
 germanium
 zone-refining 203
 junction
 power regulation 344-49
 silicon alloy *illus* 230
 p-n junction, germanium *illus* 230
 construction *illus* 229
 point-contact, germanium *illus* 230
 point-contact, silicon *illus* 230
 cross-section 228
 semiconductor 227-31
 vacuum *illus* 230
- DISARMAMENT
 Fisk, J. B., task force appointment 436
- DISCHARGE
 self-propagating, intermittent 280
- Discordant Permutations* (J. Riordan) 134 (referred to)
- Dislocation Densities in Intersecting Lineage Boundaries in Germanium* (Miss L. C. Lovell, W. G. Pfann) 480 (referred to)
- Dislocation Relaxation at Low Temperatures and the Determination of the Limiting Shearing Stress of a Metal* (W. P. Mason) 320 (referred to)
- DISLOCATION THEORY
 acceptor centers, occupation of 34
 crystals 285-89
 electrons, scattering, in semiconductors 198
 germanium, crystals 104-07
 germanium, low-angle boundaries 330
 germanium, polygonized 198
 lead-silver alloys 240
 temperature, relation 320, 330
- Dislocations in Germanium Crystals* (F. L. Vogel, Jr.) 104-07
- Dislocations in Low-Angle Boundaries in Germanium* (F. L. Vogel, Jr.) 330 (referred to)
- Dislocations in Polygonized Germanium* (F. L. Vogel, Jr.) 198 (referred to)

DISTANT

DISTANT EARLY WARNING LINE

- Western Electric, prime contractor 158
- Ditzenberger, J. A. *illus* 243
 - Resistivity Changes in Silicon Single Crystals Induced by Heat Treatment* 240 (referred to)
 - Diffusion of Boron and Phosphorus into Silicon* 34 (referred to)
- Doba, S., Jr.
 - New Local Video Transmission System* 320 (referred to)
- Doherty, W. H. *illus* 358
 - assistant vice president, A.T.&T. 358
- DOMAIN WALL
 - (in) nickel-iron ferrite
 - motion 134
- Domaleski, J. V. *illus* 310, 448
- Donaldson, J. C., *illus* 266
- Donohue, E. J. *illus* 180
- Dorsi, D. *illus* 201
- DOUGLAS FIR
 - preservative treatment 16-20
 - schematic drawing 17
- Driesbach, G. R. *illus* 305
- DROP BRACKET *See* Bracket
- Drop Wire Clamp Testing Machine (H. A. Wells) 70-71
- DRUM
 - magnetic
 - central office, control features 280
- DUDELL MEDAL
 - Kompfner, Rudolph, award 151
- Duhnkrack, G. H. *illus* 210
 - Analysis of No. 5 Crossbar Trouble Recorder Cards* 206-10
 - biographical material 210
- Durkee, A. L. *illus* 384
 - biographical material 384
 - New Military VHF-UHF Radio Set* 382-84
- Durkee, A. L.
 - Results of Propagation Tests at 505 Mc and 4,090 Mc on Beyond-Horizon Paths* 480 (referred to)

E

- 81D1 TELETYPEWRITER SWITCHING SYSTEM *See* Switching Systems
- Ebers, J. J.
 - Design of Alloyed Junction Germanium Transistors for High-Speed Switching* 320 (referred to)
 - Large-Signal Behavior of Junction Transistors* 34 (referred to)
- Eder, Miss M.
 - Statistically Designed Experiment of the Factorial Type Applied to Point-Contact Transistors* 240 (referred to)
- Edwards, T. E. *illus* 252
 - Effect on Performance of Tilting the Toll-Operator's Keyset* (A. Chapanis, Miss E. M. Scales) 120 (referred to)
- Ehrhardt, R. A.
 - Brass Plating* 280 (referred to)
 - Elastic Constants of Germanium between 1.7° and 80°K* (M. E. Fine) 330 (referred to)
 - Electrical Breakdown in High Vacuum* (W. S. Boyle, L. H. Germer, P. Kisliuk) 320 (referred to)
 - Electrical Conductivity and Seebeck Effect in Nickel Ferric Oxide* (T. H. Geballe, F. J. Morin) 400 (referred to)
- ELECTRICAL CONNECTION *See* Connection
- ELECTRICAL CONTACTS *See* Contact
- Electrical Contacts for Transistors and Diodes* (M. C. Waltz) 260-63
- ELECTRODE
 - virtual
 - micromachining with 480

ELECTROLYTE

- interface, with germanium, experiments 71
- Electrolytic Preparation of Molybdenum from Fused Salts, III* (G. C. Fryburg, F. Trumbore) 120 (referred to)

ELECTRON(s)

- behavior
 - (in) ferrites
 - gyro model 419-23
- diffraction patterns
 - (in) cupric oxide 400
- energies, measurement 480
- odd, in polymer molecules 480
- production, in high-energy nuclear interactions 120
- scattering, by dislocations in semiconductors 198
- production, in high-energy nuclear
 - spin resonance absorption in metals 280

ELECTRON(s) AND HOLES

- germanium, recombination
 - radiation, new 330
- Hall effect 85
- p-n junction
 - distribution *illus* 168

ELECTRON BEAM(s)

- devices, power flow in 240
- focusing, magnetic 198
 - positive-ion drainage 439
- pin-hole-camera inspection 198
- power flow 400

ELECTRON GUN

- thermal velocity effect 198

ELECTRON IMPACT

- carbon monoxide, experiments 330
- nitric oxide, experiments 330
- nitrogen, experiments 330
- oxygen, experiments 330

ELECTRON MICROSCOPE

- surface studies with 439
- Electron Production in High-Energy Nuclear Interactions* (F. E. Froelich, I. Nadelhaft, K. Sitte) 120 (referred to)

- Electron Spin Resonance Absorption in Metals, I—Experimental* (G. Feher, A. F. Kip) 280 (referred to)

ELECTRON TUBES

- applications 1
- gas in 3-5
- glow-discharge, gas
 - applications 1
- microwave
 - advances, recent 34
 - wave picture 34
- noise, sources 134
- research 1
- traveling-wave
 - (at) millimeter wavelength, experiments 120
- traveling-wave, with uniform helix
- noise figure, minimum 34
- vacua 1

ELECTRONIC CIRCUIT *See* Circuit

- Electronic Conductors* (K. K. Darrow) 85-89

ELECTRONIC COUPLING UNIT *See* Coupling Unit

ELECTRONIC LOOP REPEATER *See* Repeater

ELECTRONICS

- chemist's role 330

ELECTROPLATING

- brass 280

- Emergency Radio Telephone System* (R. W. Collins, F. B. Combs) 365-68

EMERGENCY REPORTING SYSTEM

- development 359

EMISSION

- (from) cathodes, hollow 439
- thermionic
 - tungsten, velocity analysis 320
- Emission from Hollow Cathodes* (K. M. Poole) 439 (referred to)
- Empirical Relation between Superconductivity and the Number of Valence Electrons per Atom* (B. T. Matthias) 120 (referred to)
- Engelhardt, George B. *illus* 146, 148
 - High-Voltage Problems in the L3 System* 146-148
- Engineering Multistage Diode Logic Circuits* (W. Ulrich, B. J. Yokelson) 439 (referred to)

ENGINEERS

- graduate
 - creative technology, training, M. J. Kelly recommendation 211
 - training programs 439

ENUMERABILITY

- axiom, consistency of 280
- Equalization in the L3 System* (E. G. Morton) 390-93
- Equalization of Cables for Local Television Transmission* (Miss C. L. Lakin, P. W. Rounds) 320 (referred to)

EQUALIZER(s)

- adjustable
 - L3 coaxial system 468-71
 - simplified schematic 470

EQUALIZING REPEATER *See* Repeater

- Equipment and Mechanical Features of the AN/TRC-24 Radio Set* (V. I. Cruser) 34 (referred to)

- Esternaux, Max E. *illus* 65, 69

- biographical material 69
- Connectors in 4A Toll Crossbar* 65-69

- Etch Patterns and Ferroelectric Domains in Barium Titanate Single Crystals* (J. Hooton, W. J. Merz) 280 (referred to)

E-TYPE REPEATER *See* Repeater

- E-Type Telephone Repeaters—Description, Equipment, and Testing* (J. O. Smethurst) 34 (referred to)

Evans, H. W.

- Protection of Service in the TD-2 Radio Relay System by Automatic Channel Switching* 240 (referred to)

- Evaporation of Barium and Strontium from Oxide-Coated Cathode* (G. E. Moore, A. E. Ruehle, L. A. Wooten) 134 (referred to)

- Evolution of Modern Television* (A. G. Jensen) 34 (referred to)

Ewing, N. S.

- Patent Law as a Career* 198 (referred to)

- Excess Barium Content of Practical Oxide Coated Cathodes and Thermionic Emission* (G. E. Moore, J. Morrison, L. A. Wooten) 400 (referred to)

- Experimental Extrusion of Aluminum Cable Sheath at Bell Telephone Laboratories* (G. M. Bouton, J. H. Heiss, G. S. Phipps) 240 (referred to)

- Experimental Polytonic Signaling System* (C. A. Lovell, J. H. McGuigan, O. J. Murphy) 320 (referred to)

EXPERIMENTAL STATISTICS *See* Statistics

- Experiments on the Interface between Germanium and an Electrolyte* (W. H. Brattain, C. G. B. Garrett) 71 (referred to)

F

FM *See* Frequency Modulation

- 4-TYPE SWITCHING SYSTEMS *See* Switching Systems

- 4A CROSSBAR SYSTEM *See* Crossbar Systems

- 4A FREQUENCY ANALYZER *See* Frequency Analyzer

- 4M SWITCHING SYSTEM *See* Switching Systems

- 5-TYPE CROSSBAR SYSTEMS *See* Crossbar Systems

- 5U TEST SET *See* Test Set

- 56A OSCILLATOR *See* Oscillator

- 416B PLANAR TRIODE *See* Triode

- 419A REFLEX KLYSTRON *See* Klystron

- 431A REFLEX KLYSTRON *See* Klystron

- 532-TYPE TELEPHONE SET *See* Telephone Set

- Factors Affecting Physical Structure of Dry Pressed Steatite* (J. R. Fisher, J. F. Potter) 330 (referred to)

Fagen, M. D.

- I.R.E. Professional Group chairman 476

- Farnham, H. V. *illus* 154

- FAST COMBINATION CONTACT *See* Contact

Fay, C. E.

- I.R.E. Fellow 473

- Feder, M. *illus* 152, 153

- Feedback Relations in Military Weapons Systems* (R. C. Newhouse) 280 (referred to)

Feher, G.

- Electron Spin Resonance Absorption in Metals, I—Experimental* 280 (referred to)

Felch, E. P.

- Simple Circuit for Frequency Standards Employing Over-tone Crystals* 280 (referred to)

Felker, J. H.

- I.R.E. Professional Group chairman 476

FELLOWSHIPS, Laboratories

- committee named 465

- Ferri, R. T. *illus* 6

FERRITE(s)

- aluminum, magnesium-manganese
 - ferromagnetic resonance between 160 and 1,900 Mc 439

- anisotropy 480

- electron behavior

- gyro model 419-23

- magnetostriction 480

- (in) microwave region

- applications 71

- behavior 71

- nickel-iron

- domain wall, motion 134

- ferromagnetic resonance 134, 439

- relaxation, acoustic, low-temperature 119

- permeability, complex tensor 34

- relaxation phenomena 320

- Ferrite Isolators at 11,000 Megacycles* (J. P. Schafer) 385-89

FERROELECTRIC CERAMICS *See* Ceramic

- Ferro Magnetism at Microwave Frequencies and Its Applications* (J. H. Rowen) 240 (referred to)

FERROELECTRIC(s)

- new class of 280

FERROELECTRIC CRYSTALS *See* Crystal

- Ferroelectric Storage Devices* (J. R. Anderson, W. J. Merz) 335-42

- Ferroelectrics and the Dielectric Amplifier* (W. P. Mason, R. F. Wick) 34 (referred to)

FERROMAGNETIC RESONANCE

- ferrite, nickel, between one and two kilomegacycles 134

- ferrite, nickel-iron 439

- magnesium-manganese aluminum ferrite between 160 and 1,900 Mc 439

- Ferromagnetic Resonance in Ferroxidure* (P. W. Anderson, M. T. Weiss) 320 (referred to)

- Ferromagnetic Resonance in Magnesium-Manganese Aluminum Ferrite between 160 and 1,900 Mc* (J. L. Davis, H. Suhl, L. G. Van Uitert) 439 (referred to)

- Ferromagnetic Resonance in Nickel Ferrite between One and Two Kilomegacycles* (H. Suhl) 134 (referred to)

- Ferromagnetic Resonance in Two Nickel-Iron Ferrites* (J. K. Galt, F. R. Merritt, W. A. Yager) 439 (referred to)

FERROMAGNETISM

FERROMAGNETISM

microwave frequencies, applications 240

FERROXIDURE

ferromagnetic resonance 320

microwave frequencies, behavior 330

Fetzer, Karl M. *illus* 30, 33

biographical material 33

Intertoll Features of No. 5 Crossbar 30-33

Fewer, D. R.

Audio-Frequency Circuit Model of the 1-Dimensional Schroedinger Equation and Its Sources of Error 439 (referred to)

FIELD-EFFECT TRANSISTOR *See* Transistor

Field-Effect Transistor (I. M. Ross) 167-72

FIELD TRIALS

Bell System outside plant 251-55

FILM *See* Anode Film

Filters for Type-O Carrier (E. S. Willis) 137-40

Fine, M. E.

Apparatus for Measuring the Elastic Moduli and Internal Friction of Solids from 1.7 to above 77 K and Some Values for α -Quartz 119 (referred to)

Elastic Constants of Germanium between 1.7° and 80° K 330 (referred to)

Low-Temperature Acoustic Relaxation in Nickel-Iron Ferrites 119 (referred to)

FINE-WIRE PYROMETER *See* Pyrometer

FINLINE COUPLER *See* Coupler

First Conference on Training Personnel for the Computing Machine Field (F. Hohn) 280 (referred to)

Fisher, J. R.

Factors Affecting Physical Structure of Dry Pressed Steatite 330 (referred to)

Significant Factors Affecting the Structure of Dry Pressed Steatite 320 (referred to)

Fisk, James B. *illus* 276

biographical material 276

disarmament task force appointment 436

Executive Vice President of Laboratories 276

I.R.E. Fellow 38

Laboratories Director, election 475

National Academy of Sciences, membership 235

FLAG-TYPE SHIELDING *See* Shielding

Flint, E. W. *illus* 355

Flood, W. F. *illus* 241

FLUORINE *See* Cesium Fluoride; Dimethylamine-Boron-Trifluoride; Rubidium Fluoride Sodium Fluoride

Foltz, Ralph P. *illus* 267, 270

biographical material 270

Cama, Transverter and Billing Indexer 267-70

FORD MOTOR COMPANY

dial system installed 398

Foreign Area Translation in No. 5 Crossbar (C. F. Knep-
per) 54-57

FOREST PRODUCTS LABORATORY *See* United States Forest
Products Laboratory

Formation and Properties of Polymer Carbon (W. O. Baker,
W. Matreyek, N. R. Pape, F. H. Winslow) 320, 480
(referred to)

FOURIER COEFFICIENTS

having isolated singularities

magnitude, order of 240

Fox, A. Gardner *illus* 423

biographical material 423

*Behavior and Applications of Ferrites in the Microwave
Region* 71 (referred to)

Gyro Model of Electron Behavior in Ferrites 419-23

I.R.E. Fellow 473

Wave Coupling by Warped Normal Modes 320 (re-
ferred to)

Foy, P. W. *illus* 169

Francois, E. E.

Adsorption of Gases and Vapors on Germanium 439 (re-
ferred to)

Franke, H. C.

Noise Measurements on Telephone Circuits 134 (re-
ferred to)

Freeman, W. *illus* 393

FREQUENCY

standards

circuit, using overtone crystals 280

Frequency-Aging of High-Frequency Plated Crystal Units
(A. W. Warner) 330 (referred to)

FREQUENCY ANALYZER

4A 35-38; *illus* 35

block diagram 36

10A 35; *illus*

Frequency Dependence of Magnetocrystalline Anisotropy
(R. M. Bozorth, J. K. Galt, B. B. Getlin, F. R. Merritt,
W. A. Yager) 480 (referred to)

FREQUENCY MODULATION

interference, interchannel, under noise loading conditions
240 (referred to)

*Frequency Response Approach to the Design of a Mechani-
cal Servo* (H. A. Helm) 34 (referred to)

Friis, Harold T.

Valdemar Poulsen Gold Medal, award 38

Froelich, F. E.

*Mean Free Path for Shower Production by High-Energy
Pi Mesons* 119 (referred to)

Electron Production in High-Energy Nuclear Interactions
120 (referred to)

Frosch, C. J.

solar battery, further development 166

Frost, H. B.

Cathode Interference Impedance Desimplified 280 (re-
ferred to)

Fryburg, G. C.

*Electrolytic Preparation of Molybdenum from Fused
Salts, III* 120 (referred to)

Fuller, Calvin S. *illus* 242, 246

biographical material 246

Bell Solar Battery 241-46

Diffusion of Boron and Phosphorus into Silicon 34
(referred to)

Ionization and Solubility in Semiconductors 134 (re-
ferred to)

*Resistivity Changes in Silicon Single Crystals Induced by
Heat Treatment* 240 (referred to)

solar battery, invention 166

Fuller, Wesley

acting Director of Publication 238

Fullerton, William O. *illus* 418

biographical material 418

Program Switching in TD-2 Radio Relay 415-18

FUSED SILICA *See* Silica

G

GSF 327 CONNECTOR *See* Connector

GSF 405 CONNECTOR *See* Connector

GALLIUM

alloys, *see* Alloy

Galt, J. K. *illus* 285, 289

Ferromagnetic Resonance in Two Nickel-Iron Ferrites
439 (referred to)

Frequency Dependence of Magnetocrystalline Anisotropy
480 (referred to)

*Motion of Individual Domain Walls in a Nickel-Iron
Ferrite—Erratum* 134 (referred to)

- Gammie, J.
Stability of Negative Impedance Elements in Short Transmission Lines 134 (referred to)
- Garn, Paul D. *illus* 451, 452, 454
 biographical material 454
Differential Thermal Analysis 451-54
Polarographic Determination of Phthalic and Anhydride Alkyd Resins 480 (referred to)
- Garrett, C. G. B.
Experiments on the Interface between Germanium and an Electrolyte 71 (referred to)
Physical Theory of Semiconductor Surfaces 400 (referred to)
Surface Properties of Semiconductors 134 (referred to)
- GAS
 electron tubes 1, 3-5
 germanium, adsorption on 330, 439
- Gassing of Liquid Dielectrics under Electrical Stress (H. Basseches, D. A. McLean) 439 (referred to)
- GAUGE
 Buckley 3
 ion *illus* 3
- Gawel, G. A. *illus* 153
- Geballe, T. H.
Electrical Conductivity and Seebeck Effect in Nickel Ferric Oxide 400 (referred to)
Seebeck Effect in Silicon 320 (referred to)
- Geller, S.
Crystal Structure and Quadrupole Coupling of Cyanogen Bromide, BrCN 320 (referred to)
Crystal Structure of Cobalt Silicide 198 (referred to)
Crystal Structure of Rhodium Selenide 320 (referred to)
Crystal Structure of Rhodium Telluride 280 (referred to)
Note on the Structure of Dimethylamine-Boron-Trifluoride 198 (referred to)
Rhodium-Germanium System I 134 (referred to)
Some New Intermetallic Compounds with the β -Wolfram Structure 240 (referred to)
- General Sources of Noise in Vacuum Tubes (J. R. Pierce) 134 (referred to)
- Generalizations of Brillouin Flow (L. R. Walker) 320 (referred to)
- GENERATOR
 pulse, regenerative 134
- GERMANIUM
 alloys, *see* Alloy
 avalanche breakdown 439
 boundaries, low-angle
 dislocations 330
 conductivity, research study 90-92
 crystals, *see* Crystal
 deformation, plastic, by torsion 119
 elastic constants, between 1.7° and 80° K 330
 electrons and holes, recombination radiation, new 330
 gases, adsorption 330, 439
 impurity centers 134
 ingot, zone-refined *illus* 204
 interface, with electrolyte, experiments 71
 melting point 119, 480
 polycrystalline *illus* 42
 polygonized, dislocations 198
 semiconductor research 327
 slip 400
 vapors, adsorption 439
 water vapor, adsorption 120
See also Rhodium-Germanium System
- GERMANIUM DIODE *See* Diode
- GERMANIUM DIOXIDE
 water vapor, adsorption 120
- Germanium-Silicon Phase Diagram (A. J. Goss, F. X. Hassion, F. A. Trumbore) 480 (referred to)
- GERMANIUM TRANSISTOR *See* Transistor
- Germanton, C. E. *illus* 193, 196
 biographical material 196
Cama-Position Link Frame 193-96
- Germer, L. H.
Arcing at Electrical Contacts on Closure. Part VI.—The Anode Mechanism of Extremely Short Arcs 280 (referred to)
Electrical Breakdown in High Vacuum 320 (referred to)
- Getlin, B. B.
Frequency Dependence of Magnetocrystalline Anisotropy 480 (referred to)
- GETTERING PHENOMENA
 barium, in carbon monoxide 280
 vacua, ultra-high 4-5
- Gianola, U. F.
Application of the Wiedemann Effect to the Magnetostrictive Coupling of Crossed Coils 439 (referred to)
- Gibson, J. W. *illus* 125
- Gilbert, E. N.
Optimum Design of Directive Antenna Arrays subject to Random Variations 240 (referred to)
- Gillich, J. J. *illus* 204
- Gilman, G. W.
 Director of Telegraph, Signaling and Special Systems Development 277
Transatlantic Telephone Cable 198 (referred to)
- GLASS
 silica
 conductivity, ionic
 activation energy, calculation 71
- GLOW-DISCHARGE GAS TUBES *See* Electron Tubes
- Goddard, C. T.
Measurement of Surface Flatness of Cathodes for Close Spaced Electron Tubes 330 (referred to)
- GOLD
 irradiation effects near 10° K 198
- GOLD
See also Copper Auride
- Goldstein, R.
Some New Intermetallic Compounds with the β -Wolfram Structure 240 (referred to)
- Gonsior, Albert N. *illus* 159
 Sigma Tau Distinguished Service Award 159
- Goss, A. J.
Germanium-Silicon Phase Diagram 480 (referred to)
Semiconductor Devices Made with Single Crystal Germanium Silicon Alloys 120 (referred to)
- Gould, K. E.
 BSTJ Editorial Committee, appointment 371
 Laboratories Fellowships Committee 465
- GOVERNOR *See* Dial Telephone
- Governor for Telephone Dials—Principles of Design (W. Pferd) 34 (referred to)
- Graham, R. Sheils *illus* 468, 471
Adjustable Equalizer for the L3 Coaxial System 468-71
 biographical material 471
- Grant, W. R. *illus* 13
- Green, Estill I. *illus* 276
 biographical material 276-77
 I.R.E. Fellow 38
Story of Q 480 (referred to)
 Vice President of the Laboratories 276
- Greiner, E. S.
Melting Point of Germanium and the Constitution of Some Germanium-Gallium Alloys 119 (referred to)
Plastic Deformation of Germanium and Silicon by Torsion 119 (referred to)

GRID

GRID NOISE See Noise

Grounding of Portable Electric Equipment (L. S. Inskip, H. N. Watson) 240

GROUP CIRCUIT See Circuit

GROWN JUNCTION TRANSISTOR See Transistor

Grown Junction Transistor Development (K. D. Smith) 374-78

Grzyb, Chester illus 83

GUIDED MISSILE See Nike

Guldner, W. G.

Measurement of Excess Barium in Practical Oxide Coated Cathodes 400 (referred to)

GULFPORT, MISSISSIPPI TEST PLOT illus 254

GUN See Electron Gun

Gyro Model of Electron Behavior in Ferrites (A. G. Fox) 419-23

H

HAAS EFFECT

sound, stereophonic, reproduction, enhancement 320

Hagstrum, H. D.

Reinterpretation of Electron Impact Experiments in Carbon Monoxide, Nitrogen, Nitric Oxide, and Oxygen 330 (referred to)

HALL EFFECT

conductors, electronic 85

schematic representation 86

Halline, Mrs. E. W.

Polarographic Determination of Phthalic and Anhydride Alkyd Resins 480 (referred to)

Halsey, R. J.

Transatlantic Telephone Cable 198 (referred to)

Hamilton, B. H.

Semiconductor Devices in Regulated Amplifiers 119 (referred to)

Some Applications of Semiconductor Devices in the Feedback Loop of Regulated Metallic Amplifiers 119 (referred to)

Hanley, F. H.

New Telegraph Serviceboard Using Electronic Circuits 198 (referred to)

Hanna, O. A. illus 98

Bell System Participation in ASTM Pole Research 98-99

Hannay, N. B.

Resistivity Changes in Silicon Single Crystals Induced by Heat Treatment 240 (referred to)

Silicon n-p-n Crown Junction Transistors 320 (referred to)

Hard Rubber (H. Peters) 439 (referred to)

HARD OF HEARING

telephone set, 532-type 36-63

Harrower, G. A.

Coaxial Electrical Connection into Vacuum 280 (referred to)

Measurement of Electron Energies by Deflection in a Uniform Electric Field 480 (referred to)

Hartley, R. V. L.

New System of Logarithmic Units 119 (referred to)

Hartman, C. D. illus 1

Haskell, F. V. illus 165

biographical material 165

Prelashing Aerial Telephone Cable 161-65

Hasson, F. X.

Germanium-Silicon Phase Diagram 480 (referred to)

On the Melting Point of Germanium 480 (referred to)

Haus, H. A.

Minimum Noise Figure of Microwave Beam Amplifiers 400 (referred to)

HAWAIIAN TELEPHONE CABLE

projected 358-59

Hawks, V. J. illus 112

biographical material 112

Type-O Carrier—Terminal Alarm Circuits 109-12

Hawley, Melville S. illus 8, 10

biographical material 10

Condenser Microphone as an Acoustic Standard 6-10

Haynes, J. R.

New Radiation Resulting from Recombination of Holes and Electrons in Germanium 330 (referred to)

Trapping of Minority Carriers in Silicon. Part I: P-Type Silicon 134 (referred to)

Hayward, W. S., Jr. illus 128

Heald, Henry T. illus 235

Hearn, A. H. illus 254

Creosote Retention as Determined by Toluene Extraction of Treated Wood 240 (referred to)

Hecht, G.

Telephone Switching Network and Its Electronic Control 134 (referred to)

Hecker, Walter illus 98

Heidenreich, R. D. illus 409

biographical material 409

Inner Structure of Alnico 5 405-09

Note on Electron Diffraction Patterns of Cupric Oxide 400 (referred to)

Thermionic Emission Microscopy of Metals—Part I. General 320 (referred to)

Thermionic Emission Microscopy of Metals II—Transformations in Plain Carbon Steels 330 (referred to)

Transition Structure in Lead-Silver Alloys and a Dislocation Mechanism 240 (referred to)

Heiss, J. H.

Experimental Extrusion of Aluminum Cable Sheath at Bell Telephone Laboratories 240 (referred to)

HELICAL WAVEGUIDE See Waveguide

HELIUM II

film transport

film height, role of 400

substrate, role of 280

surface finish, role of 439

temperature, role of 439

Helium II Film Transport. I—The Role of Substrata (H. A. Boorse, B. Smith) 280 (referred to)

Helium II Film Transport. II. The Role of Surface Finish (H. A. Boorse, B. Smith) 439 (referred to)

Helium II Film Transport. III. The Role of Film Height (H. A. Boorse, B. Smith) 400 (referred to)

Helium II Film Transport. IV. The Role of Temperature (H. A. Boorse, B. Smith) 439 (referred to)

Helm, H. A.

Frequency Response Approach to the Design of a Mechanical Servo 34 (referred to)

Henderson, Barbara J. illus 253, 255

biographical material 255

Outside Plant Field Trials 251-55

Henley, E. J. illus 366

Henneberger, T. C. illus 253

Hensel, W. G. illus 431

AN/TRC-24 Radio Transmitter 428-31

biographical material 431

Herborn, Ludwig E. illus 22, 24

biographical material 24

Precision 30-Mc Admittance Bridge 21-24

Herring, Conyers illus 285, 289

biographical material 289

Strength of Small Metal Specimens 285-89

Magnetoresistance Effect and the Band Structure of Single Crystal Silicon 134 (referred to)

Theory of the Thermoelectric Power of Semiconductors 120 (referred to)

- Transport Properties of a Many-Valley Semiconductor* 134 (referred to)
- Hersey, R. E. *illus* 32
- High-Frequency Gas Discharge Plasma in Hydrogen* (S. C. Brown, D. J. Rose) 280 (referred to)
- HIGH VACUA See Vacua
- HIGH VACUUM SPUTTERING See Sputtering
- High-Voltage Problems in the L3 System* (G. B. Engelhardt) 146-48
- Hines, M. E.
Positive-Ion Drainage in Magnetically Focused Electron Beams 439 (referred to)
Thermal Velocity Effects in Electron Guns 198 (referred to)
- Hochgraf, Lester
Telephone Lines for Rural Subscriber 280 (referred to)
- Hoefle, R. R.
System Plan for Air Traffic Control Embodying the Cussor-Coordinated Display 400 (referred to)
- Hoffman, G. W.
Positive-Ion Drainage in Magnetically Focused Electron Beams 439 (referred to)
- Hoffman, J. P.
New Military Carrier Telephone Systems Equipment Features 34 (referred to)
- Hohn, Franz E.
Boolean Matrices and the Design of Combinational Relay Switching Circuits 71 (referred to)
First Conference on Training Personnel for the Computing Machine Field 280 (referred to)
Some Mathematical Aspects of Switching 198 (referred to)
- Holden, A. N.
New Class of Ferroelectrics 280 (referred to)
- HOLE(S) AND ELECTRONS See Electron(s) and Holes
- HOLLOW CATHODE See Cathode
- Honaman, R. Karl *illus* 238
 biographical material 238
 Deputy Assistant Secretary of Defense for Public Affairs, appointment 238
- Hooton, J. A.
Etch Patterns and Ferroelectric Domains in Barium Titanate Single Crystals 280 (referred to)
- HORN ANTENNA, broadband See Antenna
- HORN EQUATION, Webster's 330
- Hornbeck, J. A.
 Laboratories Fellowships committee 465
Trapping of Minority Carriers in Silicon. Part I: P-Type Silicon 134 (referred to)
- Hornung, G. T. *illus* 410
- Horton, A. W., Jr.
Transmission of Digital Information over Telephone Circuits 240 (referred to)
- Hough, R. R.
 Director of Military Electronics Development II 277
- Hovgaard, Ole M. *illus* 357
 biographical material 357
Development of Reed Switches and Relays 134 (referred to)
Sealed Switch Relays for AMA 355-57
- Hrostowski, H. J.
Recent Work on Group III Antimonides and Arsenides 134 (referred to)
- HUB CIRCUIT See Circuit
- Huber, George H. *illus* 290, 292, 293
 biographical material 292
Military Communication Network Using Wire and Radio 290-93
New Military Carrier Telephone System 274-75
New Military Carrier Telephone Systems 34 (referred to)
- Hull, G. W.
Seebeck Effect in Silicon 320 (referred to)
- Huntley, H. R.
Revised Telephone Transmission Rating Plan 240 (referred to)
- Hutson, A. R.
Velocity Analysis of Thermionic Emission from Single-Crystal Tungsten 320 (referred to)
- HYDROGEN
 gas discharge plasma, high-frequency 280
Hyperfine Splitting of Donor States in Silicon (W. Kohn, J. M. Luttinger) 34 (referred to)
- I
- I.R.E. See Institute of Radio Engineers
- Ice (C. J. Calbick) 34 (referred to)
- Ignatowicz, M. *illus* 218
- Ilsey, R. L. *illus* 395
- IMAGE, optical
 NBS circular 526, evaluation 330
- IMMINENT DISCHARGE See Discharge
- IMPACT, electron See Electron Impact
- IMPEDANCE
 cathode, interference desimplified 280
 See also Negative Impedance
- IMPEDANCE INVERTER See Inverter
- Improved Detached-Contact Type of Schematic Circuit Drawing* (F. T. Meyer) 439 (referred to)
- Improved Testing Instructions for Type-O Carrier* (C. I. L. Cronburg, Jr.) 299-302
- Improvements in Wiper Springs for Step-by-Step Switches* (F. W. Clayden) 372-73
- Impurity Centers in Germanium and Silicon* (J. A. Burton) 134 (referred to)
- In-Band Single-Frequency Signaling* (N. A. Newell, A. Weaver) 34 (referred to)
- INDEXER, billing
 automatic message accounting, centralized 267-70
 block diagrams 268, 269
- INDUSTRIAL RESEARCH
 role in society 120
- INFORMATION
 digital, transmission, over telephone circuits 240
 storage
 ferroelectric devices 331-34
 matrix system
 circuit, diagram 342
- Ingram, S. B.
 Laboratories Fellowships committee 465
- Injected Carrier Current Transport in a Semi-Infinite Semiconductor and the Determination of Lifetimes and Surface Recombination Velocities* (W. Van Roosbroeck) 280 (referred to)
- Inkster, W. J.
Results of Propagation Tests at 505 Mc and 4,090 Mc on Beyond-Horizon Paths 480 (referred to)
- Inner Structure of Alnico 5* (E. A. Nesbitt, R. D. Heidenreich) 405-09
- Inskip, L. S.
Grounding of Portable Electric Equipment 240 (referred to)
- INSTITUTE OF RADIO ENGINEERS
 Laboratories members chairmen of Professional Groups 476-77
 Laboratories members chairmen of Technical Committees 477
 Laboratories Members named Fellows 38, 473
 Morris Liebmann Prize awarded to Kenneth Bullington 399

INSULATION

INSULATION

- capacitors 441-44
- lacquer film 442-44
- Interaction of Moving Charges with Wave Circuits* (J. R. Pierce) 280 (referred to)
- Intercepting with Recorded Announcements* (A. R. Bertels) 331-34
- Interchannel Interference in FM and PM Systems under Noise Loading Conditions* (W. Bennett, H. E. Curtis, S. O. Rice) 240 (referred to)
- INTERFACE
 - germanium and an electrolyte, experiments 71
- INTERFERENCE
 - cathode
 - impedance, desimplified 280
- INTERMETALLIC COMPOUNDS
 - (with) β -wolfram structure 240
- INTERNATIONAL SCIENTIFIC RADIO UNION
 - Jensen, A. G., membership 476
- Intertoll Features of No. 5 Crossbar* (K. M. Fetzer) 30-33
- Introduction to Time-Variable Networks* (S. Darlington) 280 (referred to)
- INVERTER
 - impedance, circuits 330
- INVESTMENT BANKERS ASSOCIATION
 - Murray Hill television visit 435
- ION(s)
 - adsorbed
 - life history 439
 - positive
 - drainage, in magnetically focused electron beams 439
- ION GAUGE *illus* 3
- IONIC CONDUCTIVITY *See* Conductivity
- IONIZATION
 - semiconductors 134
- Ionization and Solubility in Semiconductors* (C. S. Fuller, H. Reiss) 134 (referred to)
- Irby, C. W. *illus* 112
- Irradiation Effects in Copper, Silver, and Gold near 10° K* (H. G. Cooper, J. S. Koehler, J. W. Marx) 198 (referred to)
- ISOLATOR
 - ferrite *illus* 386
 - drawing, simplified 387
 - exploded view 386
 - (at) 11,000 megacycles 385-89
 - waveguide applications 420
- Israel, J. O. *illus* 271, 273
 - biographical material 273
 - Broadband Test Oscillator for the L3 Coaxial Carrier System* 271-73
 - Simple Circuit for Frequency Standards Employing Over-tone Crystals* 280 (referred to)

J

- JACK MOUNTING
 - 252A *illus* 343
 - plastic, molded, use 343
- JACKSON, MISSISSIPPI
 - radio relay route 437
- Jacobitti, Edward *illus* 141, 144, 145
 - Automatic Alternate Routing in the 4A Crossbar System* 141-45
 - biographical material 145
- Jacobson, A. F. *illus* 116
 - biographical material 116
 - Northwestern Bell Telephone Company President 116
- James, D. A. *illus* 97, 217, 294, 297, 298
 - biographical material 298
 - Translator Card in Toll Crossbar* 294-98

- Jamieson, J. E. *illus* 329
- Janssen, W. F. *illus* 370, 371
 - biographical material 371
 - Precision Ceramics* 369-71
- Jasinski, J. J. *illus* 442
- Jaycox, E. K.
 - Spectrochemical Procedure of General Applicability* 240 (referred to)
- Jensen, A. G.
 - biographical material 476
 - Evolution of Modern Television* 34 (referred to)
 - Society of Motion Picture and Television Engineers, Engineering Vice President 476
 - U.R.S.I. membership 476
- JET
 - supersonic
 - noise, emission 330
- Joel, A. E.
 - A.I.E.E. executive committee member 477
- Johnson, R. P. A. *illus* 98
- Johnston, R. L. *illus* 378
- Jordan, Homer G. *illus* 81, 84
 - biographical material 84
 - Miniplas—Miniature Apparatus in Plastic* 81-84
- JUNCTION
 - p-n
 - definition 169
 - discovery 241
 - electrons and holes, distribution *illus* 168
 - manufacture 242-43
 - power sources 34
- JUNCTION DIODE *See* Diode
- Junction Phototransistors* (J. N. Shive, P. Zuk) 445-49
- Junction Tetrode Transistor* (R. L. Wallace, Jr.) 121-24
- JUNCTION TRANSISTOR *See* Transistor
- Junction Transistors and Diodes for Power Regulation* (F. H. Chase) 344-49

K

- KS-14510 VOLT-OHM-MILLIAMMETER *illus* 213, 214
- Kallensee, W. F. *illus* 249
- Kane, A. C. *illus* 115
- Kaplan, E. L.
 - Signal-Detection Studies and Their Applications* 134 (referred to)
- Karnaugh, M.
 - Pulse-Switching Circuits Using Magnetic Cores* 280 (referred to)
- Karp, A.
 - Traveling-Wave Tube Experiments at Millimeter Wavelengths with a New, Easily Built, Space-Harmonic Circuit* 120 (referred to)
- de Kay, Rodman *illus* 460
 - biographical material 460
 - Why Storage Batteries?* 458-60
- Keene, F. R. *illus* 310
 - Statistically Designed Experiment of the Factorial Type Applied to Point-Contact Transistors* 240 (referred to)
- Kelley, H. P.
 - Differential Phase and Gain Measurements in Color Television Systems* 34 (referred to)
- Kelly, Mervin J. *illus* 235, 427, 432
 - Alfred P. Sloan Foundation, trustee 235
 - American Chemical Society address 399
 - Atoms for Peace Awards committee, appointment 418
 - BSTJ Editorial Committee, new members named 371
 - Christopher Columbus International Communication Prize, award 432-33
 - graduate training in creative technology for engineers, recommendation 211

- honorary degrees
 New York University 235
 Polytechnic Institute of Brooklyn 427
 Investment Bankers Association address 435
 Laboratories Fellowships committee named 465
 M.I.T. Physics Department visiting committee, chairman 475
 National Academy of Sciences, membership 235
 Naval Research Advisory committee vice chairman election 358
Role of Industrial Research and Development in Society 120 (referred to)
 Stevens Institute of Technology trustee 318
Training Programs in Industry for Graduate Engineers 439 (referred to)
Transatlantic Telephone Cable 198 (referred to)
 United States Air Force Scientific Advisory Board, chairman 117
 Kelly, W. R. *illus* 47
 Kennedy, Dorwin E. *illus* 98
 Kenney, Nancy T.
Low-Temperature Acoustic Relaxation in Nickel-Iron Ferrites 119 (referred to)
 KETCHIKAN, ALASKA
 landing site, Alaska Telephone Cable 358
 KEYSET
 toll-operator's
 tilting, effect on performance 120, 198
 Kind, Miss V. M. *illus* 53
 King, G. V.
Centralized Automatic Message Accounting System 34 (referred to)
 King, Harold T. *illus* 25, 28
 biographical material 28
Repeaters and Group Circuits in Type-O Carrier 25-28
 Kinzer, J. P. *illus* 469, 471
Adjustable Equalizers for the L3 Coaxial System 468-71
 biographical material 471
 Kip, A. F.
Electron Spin Resonance Absorption in Metals, I—Experimental 280 (referred to)
 Kircher, R. J.
Properties of Junction Transistors 400 (referred to)
 Kirkpatrick, Mrs. Constance *illus* 102
 Kisliuk, P.
Departure from Paschen's Law in Breakdown of Gases 134 (referred to)
Electrical Breakdown in High Vacuum 320 (referred to)
 KLYSTRON
 reflex
 exploded view 174
 419A 174-77
 prototypes, laboratory, characteristics, table 177
 431A 174-77; *illus* 176
 prototypes, laboratory, characteristics, table 177
 (for) microwave radio relay systems 173-77
 (as) oscillator, microwave 131-32
 tunable
 (for) operating in the 50-to- 60-kmc band 240
 tuning, electronic 173
 Knepper, Charles F. *illus* 54, 57
 biographical material 57
Foreign Area Translation in No. 5 Crossbar 54-57
 Knowlton, A. D. *illus* 364
 Kock, W. E.
 I.R.E. Professional Group chairman 476
 Koehler, J. S.
Irradiation Effects in Copper, Silver, and Gold near 10° K 198 (referred to)
 Kohn, W.
Hyperfine Splitting of Donor States in Silicon 34 (referred to)
Theory of Donor Levels in Silicon 280 (referred to)
Theory of Donor States in Silicon 320 (referred to)
 Kolb, E. D. *illus* 43, 123, frontcover May
Rate-Grown Germanium Crystals for High-Frequency Transistors 439 (referred to)
 Kolding, A. R.
New Local Video Transmission System 320 (referred to)
 Koliss, P. P.
Mechanical Splice Closures for Telephone Cables 400 (referred to)
 Koller, F. W. *illus* 58, 473
Connectors for Cable Shields 58-59
Splicers and Pads for Coaxial and Balanced-Pair Cables 472-73
 Kompfner, Rudolph
 Duddell Medal, award 151
 Kramer, H. P.
Note on the Emission of Noise by Supersonic Jets 330 (referred to)
 Kreer, J. G.
 I.R.E. Technical Committee chairman 477
 Kuchas, F. C. *illus* 56
 KURE BEACH, NORTH CAROLINA TEST PLOT *illus* 255
- ## L
- L3 COAXIAL CARRIER SYSTEM See Carrier
 LABOR COSTS
 intercepting service
 recorded announcements 332
 outside plant 161, 165
 units, factory-assembled 161
 wire-wrapping, using combinational tools 281-84
 LABORATORIES FELLOWSHIPS
 committee named 465
 LACQUER FILM CAPACITOR See Capacitor
 Lakin, Miss C. L.
Equalization of Cables for Local Television Transmission 320 (referred to)
 Lander, J. J.
 vacua, ultra-high development 3
 Lang, W. Y. *illus* 234
 biographical material 234
Teletypewriter Billing of Special Toll Calls 232-35
Large-Signal Behavior of Junction Transistors (J. J. Ebers, J. L. Moll) 34 (referred to)
Large Signal Theory of Traveling Wave Amplifiers (P. K. Tien, L. R. Walker) 439 (referred to)
Large Signal Theory of Traveling-Wave Amplifiers (P. K. Tien, L. R. Walker, V. M. Wolontis) 198 (referred to)
Large-Signal Theory of Traveling-Wave Amplifiers (L. R. Walker, V. M. Wolontis) 280 (referred to)
Large-Signal Transient Response of Junction Transistor (J. L. Moll) 34 (referred to)
 Larkin, C. F. *illus* 203
 LASHING, cable See Cable
 Law, J. T.
Adsorption of Gases and Vapors on Germanium 439 (referred to)
Adsorption of Gases on a Germanium Surface 330 (referred to)
Adsorption of Water Vapor on Germanium and Germanium Dioxide 120 (referred to)
 LAW, patent
 career, as a 198
 LAWRENCE, MASSACHUSETTS
 teletypewriter service, radio
 space diversity arrangement *illus* 463

LEAD

LEAD

- crystal, *see* Crystal
- LEAD ALLOY *See* Alloy
- LeBright, E. L.
Radio Set AN/TRC-24: Antenna 466-67
- Leutritz, J. *illus* 254
- Lewis, W. D.
Laboratories Fellowships committee 465
- LIFE EXPECTANCY
crystals, measurement 308-12
semiconductors, measurement 308-12
solar battery 243, 245
storage batteries 459-60
- Life History of Adsorbed Atoms, Ions, and Molecules*
(J. A. Becker) 439 (referred to)
- LINE(s), open-wire *See* Open-Wire Lines
- LINEAR NETWORKS
passive
definition, in terms of time and energy 120
- Linville, J. G.
Nonsaturating Pulse Circuits Using Two Junction Transistors 330 (referred to)
- LIQUID DIELECTRIC *See* Dielectric
- Liquid Nitrogen Coal Traps* (W. R. Neisser) 439 (referred to)
- Locke, George A. *illus* 321, 326
Automatic Private-Line Teletypewriter Switching System
321-26
biographical material 326
- Logan, R. A.
Semiconductor Devices Made with Single Crystal Germanium Silicon Alloys 120 (referred to)
- LOGARITHM(s)
units, new system 119
- LOGIC, truth-functional *See* Boolean Algebra
- LOGIC CIRCUIT *See* Circuit
- Loman, G. T. *illus* 310
- Long, M. B.
Secretary, Laboratories Fellowships committee 465
- Long Distance Dialing and Automatic Accounting* (T. L. Dimond) 330 (referred to)
- LONG DISTANCE SERVICE
dialing, nationwide
4A toll crossbar office conversion 188-92
repeaters 182-83
routing, automatic, alternate 141
service expansion 29
- LONG LINES DEPARTMENT
Alaska Telephone Cable, construction 358
expansion, projected 235
4A crossbar system, conversion 29
off-the-air television pickup, proposed 148
- LOOP REPEATER *See* Repeater
- Louisell, W. H.
Analysis of the Single Tapered Mode Coupler 320 (referred to)
Power Flow in Electron Beam Devices 240 (referred to)
- Lovell, C. A.
Experimental Polytonic Signaling System 320 (referred to)
- Lovell, Miss L. C. *illus* 204
Dislocation Densities in Intersecting Lineage Boundaries in Germanium 480 (referred to)
- Low-Temperature Acoustic Relaxation in Nickel-Iron Ferrites* (M. E. Fine, Nancy T. Kenney) 119
- Luke, C. L.
Determination of Traces of Boron in Silicon 330 (referred to)
Photometric Determination of Magnesium in Electronic Nickel 34 (referred to)

- Lumsden, George Q. *illus* 98, 457
biographical material 457
Precise Temperature Measurements on Bleeding Poles 455-57
- Luttinger, J. M.
Hyperfine Splitting of Donor States in Silicon 34 (referred to)
Theory of Donor Levels in Silicon 280 (referred to)
Theory of Donor States in Silicon 320 (referred to)

M

- M-4 WIRING MACHINE *See* Wiring Machine
- M.I.T. *See* Massachusetts Institute of Technology
- McCandless, C. H. *illus* 256, 259
biographical material 259
Traffic Load Control in Toll Crossbar Systems 265-59
- McCarthy, John A.
Search for Double Beta Decay in Calcium 48 240 (referred to)
- McCarty, John *illus* 364
- McCullagh, W. I. *illus* 410
- McGuigan, J. H.
Experimental Polytonic Signaling System 320 (referred to)
- Machalett, A. A.
Coaxial Electrical Connection into Vacuum 280 (referred to)
- McLean, D. A.
Gassing of Liquid Dielectrics under Electrical Stress 439 (referred to)
Miniature Lacquer Film Capacitors 34 (referred to)
- McLennan, D. R. *illus* 448
- McMillan, Brockway
Absolutely Monotone Functions 34 (referred to)
BSTJ Editorial Committee, appointment 371
Laboratories Fellowships committee 465
- McNeely, Eugene J. *illus* 433
A.T.&T. Executive Vice President 433
biographical material 433
- McSkimin, H. J.
Measurement of the Elastic Constants of Single Crystal Cobalt 280 (referred to)
Transducer Design for Ultrasonic Delay Lines 240 (referred to)
- Magnetically Regulated Portable Battery Charger* (R. E. D. Anderson) 119 (referred to)
- MAGNETISM
See also Ferromagnetism
- MAGNETOCRYSTALLINE ANISOTROPY *See* Anisotropy
- Magneto-Resistance Effect and the Band Structure of Single Crystal Silicon* (C. Herring, G. L. Pearson) 134 (referred to)
- MAINTENANCE OF SERVICE *See* Service Maintenance
- Maita, J. P. *illus* 90, 92
germanium conductivity, research study 90
- Making Small Parts* (K. B. Clarke, J. W. Courage) 71 (referred to)
- Mallery, P. *illus* 93, 97, 215, 219
biographical material 97, 219
Operation of the Card Translator 93-97
Transistors in the 4A Crossbar System 215-19
- Mallina, R. F. *illus* 284, 398
biographical material 284
Combination Wire-Wrapping Tool 281-84
M-4 automatic wiring machine, design 398
- Malthaner, W. A.
Control Features of Magnetic-Drum Telephone Office 280 (referred to)
Manufacturing Grown Junction Transistors (F. H. Bower) 71 (referred to)

- MANY-VALLEY SEMICONDUCTORS *See* Semiconductor
- Markwardt, L. J. *illus* 98
- Marrison, W. A.
Worshipful Company of Clockmakers, Tompion Gold Medal, award 476
- Martin, William H. *illus* 399
biographical material 399
U. S. Army Director of Research and Development 399
- Marx, J. W.
Irradiation Effects in Copper, Silver, and Gold near 10° K 198 (referred to)
- Mason, D. R.
Design Method for the Calculation of Stagewise Reaction Systems 71 (referred to)
- Mason, W. P.
Aging of the Properties of Barium Titanate and Related Ferroelectric Ceramics 134 (referred to)
Dislocation Relaxation at Low Temperatures and the Determination of the Limiting Shearing Stress of A Metal 320 (referred to)
Ferroelectrics and the Dielectric Amplifier 34 (referred to)
Relaxations in the Attenuation of Single Crystal Lead at Low Temperatures and Their Relation to Dislocation Theory 330 (referred to)
Ultrasonic Attenuation in Normal Conducting Lead at Low Temperatures 134 (referred to)
- MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Physics Department visiting committee, Kelly, M. J., chairman 475
transmission, microwave, over-the-horizon 197-98
- Massonneau, R. F.
"Time of Day" Goes Magnetic 364
- Matreyek, W.
Formation and Properties of Polymer Carbon 320, 480 (referred to)
- MATRICES, Boolean *See* Boolean Algebra
- Matthias, B. T.
Empirical Relation between Superconductivity and the Number of Valence Electrons per Atom 120 (referred to)
New Class of Ferroelectrics 280 (referred to)
Some New Intermetallic Compounds with the β -Wolfram Structure 240 (referred to)
- Maupin, J. T. *illus* 351
Measuring Relative Phase Shift at VHF 350-51
- May, Allen S. *illus* 404
biographical material 404
Broadband Horn Reflector Antenna 401-04
- Mead, Sallie P. *illus* 125
- Mean Free Path for Shower Production by High-Energy Pi Mesons (F. E. Froelich, K. Sitte) 119 (referred to)
- Measurement of Electron Energies by Deflection in a Uniform Electric Field (G. A. Harrower) 480 (referred to)
- Measurement of Excess Barium in Practical Oxide Coated Cathodes (W. G. Guldner, G. E. Moore, L. A. Wooten) 400 (referred to)
- Measurement of Surface Flatness of Cathodes for Close Spaced Electron Tubes (C. T. Goddard) 330 (referred to)
- Measurement of the Complex Tensor Permeability of Ferrites (J. H. Rowen, W. Von Aulock) 34 (referred to)
- Measurement of the Elastic Constants of Single Crystal Cobalt (H. J. McSkimin) 280 (referred to)
- Measurement Techniques for Multimode Waveguides (A. C. Beck) 280, 480 (referred to)
- Measurements and Collision—Radiation Damage Theory of High-Vacuum Sputtering (F. Keywell) 280 (referred to)
- Measuring Relative Phase Shift at VHF (J. T. Maupin) 350-51
- Mechanical Splice Closures for Telephone Cables (P. P. Koliss) 400 (referred to)
- Mehring, A. C. *illus* 352, 354
biographical material 354
PBX Allotter for Number 5 Crossbar 352-54
- Melhuish, L. E. *illus* 464
- Melanson, J. C. *illus* 146
- MELTING, zone *See* Zone Melting
- Melting Point of Germanium and the Constitution of Some Germanium-Gallium Alloys (P. Breidt, Jr., E. S. Greiner) 119 (referred to)
- Mendel, J. T.
Magnetic Focusing of Electron Beams 198 (referred to)
- Mendizza, A. *illus* 255
- MERCURY-CONTACT RELAY *See* Relay
- MERCURY DIFFUSION PUMP—*See* Pump
- Merrill, J. L., Jr.
Repeater Amplifies in Either Line Direction 120 (referred to)
Stability of Negative Impedance Elements in Short Transmission Lines 134 (referred to)
Theory of E-Type Repeaters 34 (referred to)
- Merritt, F. R.
Ferromagnetic Resonance in Two Nickel-Iron Ferrites 439 (referred to)
Frequency Dependence of Magnetocrystalline Anisotropy 480 (referred to)
- Mertz, Pierre
Transmission Line Characteristics and Effects on Pulse Transmission 198 (referred to)
- Merz, Walter J. *illus* 335, 341
biographical material 341
Etch Patterns and Ferroelectric Domains in Barium Titanate Single Crystals 280 (referred to)
Ferroelectric Storage Devices 335-42
New Class of Ferroelectrics 280 (referred to)
- MESON
electrons, spin resonance, absorption 280
limiting shearing stress, determination 320
microscopy, thermionic emission 320, 330
pi
shower production
mean free path 119
- METAL(s)
refining, *see* Zone-Melting
- METALLIC RECTIFIERS *See* Rectifier
- METALLIZED LACQUER-FILM CAPACITOR *See* Capacitor
- METALLURGY
zone-melting 201-05
- METER
KS-14510 volt-ohm-milliammeter *illus* 213, 214
- Meyer, F. T.
Improved Detached-Contact Circuit Drawing 400 (referred to)
Improved Detached-Contact Type of Schematic Circuit Drawing 439 (referred to)
- Meyer, W. J., Jr. *illus* 151
biographical material 151
Traffic Registration in 4A Toll Crossbar 149-51
- MICRO-BALANCE *See* Balance
- Micromachining with Virtual Electrodes (A. Uhler, Jr.) 480 (referred to)
- MICROMANIPULATOR *illus* 289
- MICROPHONE
calibration, early 10
condenser
(as) acoustic standard 6-10

MICROPHONE

MICROPHONE, continued

W.E. 640AA

- applications 6-10; *illus* 8, 9
- calibration 10
- characteristics 6-8
- distortion, harmonic 9
- noise, thermal, at terminals 9
- sectional view 7

MICROSCOPY

- thermionic emission
- metals 320

MICROWAVE(s)

- polarization, plane, rotation 419-23
- radio relay system
- klystron, reflex 173-77
- over-the-horizon 197-98
- antenna *illus* 197

MICROWAVE ANTENNA See Antenna

MICROWAVE BEAM AMPLIFIER See Amplifier

MICROWAVE OSCILLATOR See Oscillator

MICROWAVE TRANSMITTER See Transmitter

MICROWAVE TUBE See Electron Tube

Military Communication Network Using Wire and Radio (G. H. Huber) 290-93

MILITARY RADIO See Radio

Miller, Bartlett T. *illus* 116

- A.T.&T. Vice President in charge of Merchandising 116
- biographical material 116

Miller, S. E.

- Behavior and Applications of Ferrites in the Microwave Region* 71 (referred to)
- Waveguide as a Communication Medium* 34 (referred to)

Miller, S. L.

- Avalanche Breakdown in Germanium* 439 (referred to)
- Design of Alloyed Junction Germanium Transistors for High-Speed Switching* 320 (referred to)

Miller, W. F.

- New Military Carrier Telephone Systems* 34 (referred to)

Millman, S.

- Laboratories Fellowships committee 465

Minaplas—Miniature Apparatus in Plastic (H. G. Jordan, W. T. Westaway) 81-84

MINAPLAS

- applications, Bell System 84
- pressing *illus* 83

Miniature Lacquer Film Capacitors (D. A. McLean, H. G. Wehe) 34 (referred to)

Miniature Metallized Lacquer-Film Capacitors (H. G. Wehe) 441-44

Miniature Transistor Amplifier (H. M. Straube) 247-50

MINIATURIZATION

- amplifier, transistor 247-50
- capacitors, lacquer-film, metallized 441-44; *illus* 443
- value of 441-42
- in plastic 81-84
- value of 441-42

Minimum Noise Figure of Microwave Beam Amplifiers (H. A. Haus, F. N. H. Robinson) 400 (referred to)

Minimum Noise Figure of Traveling-Wave Tubes with Uniform Helices (W. E. Danielson, J. R. Pierce) 34 (referred to)

MISSILE, guided See Nike

Molded Plastic Jack Mountings and Terminals (R. Morse) 343

Molds Assist the Preservation Treatment of Poles (Jean E. Perry) 16-20

MOLECULE(s)

adsorbed

- life history 439

Monk, N.

- I. R. E. Professional Group chairman 476

Molina, E. C.

- trunking developments 125

Moll, J. L.

- Large-Signal Behavior of Junction Transistors* 34 (referred to)

- Large-Signal Transient Response of Junction Transistor* 34 (referred to)

Molnar, J. P.

- vacua, ultra-high, development 4

MOLYBDENUM

- preparation, electrolytic
- electrode potentials 120

MONOTONE FUNCTIONS, absolute 34

Moore, G. E.

- Adsorption of Strontium and of Barium on Tungsten* 480 (referred to)

- Evaporation of Barium and Strontium from Oxide-Coated Cathode* 134 (referred to)

- Excess Barium Content of Practical Oxide Coated Cathodes and Thermionic Emission* 400 (referred to)

- Measurement of Excess Barium in Practical Oxide Coated Cathodes* 400 (referred to)

Morgan, S. P.

- Optimum Design of Directive Antenna Arrays subject to Random Variations* 240 (referred to)

Morin, F. J. *illus* 92

- Electrical Conductivity and Seebeck Effect in Nickel Ferric Oxide* 400 (referred to)
- germanium conductivity, research study 90

Morra, R. F. *illus* 75

Morrison, J.

- Barium Getters in Carbon Monoxide* 280 (referred to)
- Excess Barium Content of Practical Oxide Coated Cathodes and Thermionic Emission* 400 (referred to)

MORRIS LIEBMANN PRIZE

- Bullington, Kenneth, award 399

Morse, R.

- Coaxial Patch Plugs for TD-2 Radio* 450
- Molded Plastic Jack Mountings and Terminals* 343

Morton, E. G. *illus* 392, 393

- biographical material 393
- Equalization in the L3 System* 390-93

Morton, J. A.

- Director of Device Development 277
- Motion of Individual Domain Walls in a Nickel-Iron Ferrite—Erratum (J. K. Galt)* 134 (referred to)

Moulton, Horace P. *illus* 399

- A.T.&T. Vice President 399
- biographical material 399

MOUNTING, jack See Jack Mounting

Muhlsteff, R. P. *illus* 271

MULTIMODE WAVEGUIDE See Waveguide

MULTIVIBRATOR

- junction transistor
- regeneration analysis 400

Murphy, O. J.

- Experimental Polytonic Signaling System* 320 (referred to)

MURRAY HILL LABORATORY

- germanium conductivity, research study 90-92
- Investment Bankers Association television visit 435

N

No. 01 TRANSPOSITION SYSTEM See Transposition System

No. 1N85 PHOTOELECTRIC CELL See Phototransistor

- NO. 2 TELEGRAPH SERVICEBOARD *See* Serviceboard
 NO. 4 CROSSBAR SYSTEM *See* Crossbar Systems
 NO. 4A CROSSBAR SYSTEM *See* Crossbar Systems
 NO. 4M SWITCHING SYSTEM *See* Switching Systems
 NO. 5 CROSSBAR SYSTEM *See* Crossbar Systems
 NO. 5U TEST SET *See* Test Set
 NO. 6A ANNOUNCEMENT SYSTEM *See* Announcement System
 NO. 56A OSCILLATOR *See* Oscillator
 NO. 81D1 TELETYPEWRITER SWITCHING SYSTEM *See* Switching Systems
 NO. 96A1 LOOP REPEATER *See* Repeater
 NO. 105A WIRE TERMINAL *See* Terminal
 NO. 144A1 ELECTRONIC COUPLING UNIT *See* Coupling Unit
 NO. 149A TRANSISTOR AMPLIFIER *See* Amplifier
 NO. 151A AMPLIFIER *See* Amplifier
 NO. 197-TYPE SWITCH *See* Switch
 NO. 208A TERMINAL *See* Terminal
 NO. 210A TERMINAL *See* Terminal
 NO. 223 COAXIAL SWITCH *See* Switch
 NO. 252A JACK MOUNTING *See* Jack Mounting
 NO. 276 MERCURY-CONTACT RELAY *See* Relay
 NO. 291 MERCURY-CONTACT RELAY *See* Relay
 NO. 416B PLANAR TRIODE *See* Triode
 NO. 419A REFLEX KLYSTRON *See* Klystron
 NO. 431A REFLEX KLYSTRON *See* Klystron
 NO. 532-TYPE TELEPHONE SET *See* Telephone Set
 NO. 640 AA CONDENSER MICROPHONE *See* Microphone
 NO. 680A TRANSFORMER *See* Transformer
 96A1 LOOP REPEATER *See* Repeater
 Nadelhaft, I.
 Electron Production in High-Energy Nuclear Interactions 120 (referred to)
 NATIONAL ACADEMY OF SCIENCES
 Laboratories membership 235
 NATIONAL BUREAU OF STANDARDS
 circular 526, optical image evaluator 330
 NATIONAL SAFETY COUNCIL
 Bell System, awards to 212
 NATIONWIDE DIALING *See* Dial Telephone
Nature of the Uncorrelated Component of Induced Grid Noise (T. E. Talpey) 240 (referred to)
 NAVY *See* United States Navy
 NEGATIVE IMPEDANCE
 elements, in short transmission lines stability 134
 Neisser, W. R.
 Liquid Nitrogen Coal Traps 439 (referred to)
 Nesbitt, E. A. *illus* 405, 409
 biographical material 409
 Inner Structure of Alnico 5 405-09
 NETWORK(s)
 military communication
 using wire and radio 290-93
 telegraph
 serviceboard, no. 2, use 100
 television
 switching requirements 415
 time-variable 280
 transmission
 broadband
 transistor amplifiers, use 247
 coaxial carrier system, L3 21
 See also Linear Networks
New Class of Ferroelectrics (A. N. Holden, B. T. Matthias, W. J. Merz, J. P. Remeika) 280 (referred to)
New Frequency Analyzer (T. A. Spencer) 35-37
New High-Speed Recording System (G. E. Atkins) 135-36
New Local Video Transmission System (S. Doba, Jr., A. R. Kolding) 320 (referred to)
New Military Carrier Telephone System (G. H. Huber, G. Rodwin) 274-75
New Military Carrier Telephone Systems (G. H. Huber, W. F. Miller, C. W. Schramm) 34 (referred to)
New Military Carrier Telephone Systems Equipment Features (J. P. Hoffmann) 34 (referred to)
New Military VHF-UHF Radio Set (A. L. Durkee) 282-84
New Radiation Resulting from Recombination of Holes and Electrons in Germanium (J. R. Haynes) 330 (referred to)
New Supervisory Control System (C. A. Dahlbom) 304-07
New System of Logarithmic Units (R. V. L. Hartley) 119 (referred to)
New Telegraph Serviceboard Using Electronic Circuits (J. R. Davey, F. H. Hanley, M. R. Purvis) 198 (referred to)
New Ultra High Frequency Multichannel Military Radio Relay System (J. G. Nordahl) 34 (referred to)
New Volume Control Telephone (A. J. Chase) 361-63
 NEW YORK CITY
 serviceboard, telegraph no. 2, installation 103
 Newell, N. A.
 In-Band Single-Frequency Signaling 34 (referred to)
 Newhouse, R. C.
 Feedback Relations in Military Weapons Systems 280 (referred to)
 I.R.E. Fellow 473
 NICKEL *See* Alnico 5
 NICKEL FERRITE *See* Ferrite
 NICKEL IRON FERRITE *See* Ferrite
 NIKE *illus* 317
 Army press show 317
 detachments 317
 fueling *illus* 317
 performance 317
 storage *illus* 317
 Nirenberg, W. A.
 Sosine Interaction in Cesium Fluoride and Rubidium Fluoride 280 (referred to)
 NITRIC OXIDE
 electron impact experiments 330
 NITROGEN
 dielectric properties 146
 electron impact experiments 330
 liquid
 coal traps 439
 NOISE
 (in) electron tubes
 sources 134
 emission, by supersonic jets 330
 grid
 uncorrelated
 nature 240
 induced from power lines
 frequencies, analysis 35-38
 open-wire lines 45
 telephone circuits, measurement 134
 thermal
 microphone, condenser, W. E. 640 AA 9
Noise Measurements on Telephone Circuits (H. C. Franke) 134 (referred to)
 NON-INJECTING CONTACT *See* Contact
Nonsaturating Pulse Circuits Using Two Junction Transistors (J. G. Linvill) 330 (referred to)
 Nordahl, J. G.
 New Ultra High Frequency Multichannel Military Radio Relay System 34 (referred to)
Note on Electron Diffraction Patterns of Cupric Oxide (R. D. Heidenreich, K. H. Storks) 400 (referred to)

- Note on the Emission of Noise by Supersonic Jets* (H. P. Kramer) 330 (referred to)
- Note on the Structure of Dimethylamine-Boron-Trifluoride* (S. Geller) 198 (referred to)
- N-P-N GROWN JUNCTION TRANSISTOR *See* Transistor
- N-P-N JUNCTION TRANSISTOR *See* Transistor
- N-TYPE CARRIER *See* Carrier
- NUMBER 01 TRANSPOSITION SYSTEM *See* Transposition System
- NUMBER 1N85 PHOTOELECTRIC CELL *See* Phototransistor
- NUMBER 2 TELEGRAPH SERVICEBOARD *See* Serviceboard
- NUMBER 4 CROSSBAR SYSTEM *See* Crossbar Systems
- NUMBER 4A CROSSBAR SYSTEM *See* Crossbar Systems
- NUMBER 4M SWITCHING SYSTEM *See* Switching Systems
- NUMBER 5 CROSSBAR SYSTEM *See* Crossbar Systems
- NUMBER 5U TEST SET *See* Test Set
- NUMBER 6A ANNOUNCEMENT SYSTEM *See* Announcement System
- NUMBER 56A OSCILLATOR *See* Oscillator
- NUMBER 81D1 TELETYPEWRITER SWITCHING SYSTEM *See* Switching Systems
- NUMBER 96A1 LOOP REPEATER *See* Repeater
- NUMBER 105A WIRE TERMINAL *See* Terminal
- NUMBER 144A1 ELECTRONIC COUPLING UNIT *See* Coupling Unit
- NUMBER 149A TRANSISTOR AMPLIFIER *See* Amplifier
- NUMBER 151A AMPLIFIER *See* Amplifier
- NUMBER 197-TYPE SWITCH *See* Switch
- NUMBER 208A TERMINAL *See* Terminal
- NUMBER 210A TERMINAL *See* Terminal
- NUMBER 223 COAXIAL SWITCH *See* Switch
- NUMBER 252A JACK MOUNTING *See* Jack Mounting
- NUMBER 276 MERCURY-CONTACT RELAY *See* Relay
- NUMBER 291 MERCURY-CONTACT RELAY *See* Relay
- NUMBER 416B PLANAR TRIODE *See* Triode
- NUMBER 419A REFLEX KLYSTRON *See* Klystron
- NUMBER 431A REFLEX KLYSTRON *See* Klystron
- NUMBER 532-TYPE TELEPHONE SET *See* Telephone Set
- NUMBER 640 AA CONDENSER MICROPHONE *See* Microphone
- NUMBER 680A TRANSFORMER *See* Transformer

O

- O1 TRANSPOSITION SYSTEM *See* Transposition System
- 1N85 PHOTOELECTRIC CELL *See* Phototransistor
- 105A WIRE TERMINAL *See* Terminal
- 144A1 ELECTRONIC COUPLING UNIT *See* Coupling Unit
- 149A TRANSISTOR AMPLIFIER *See* Amplifier
- 151A AMPLIFIER—*See* Amplifier
- 197-TYPE SWITCH *See* Switch
- OAKLAND, CALIFORNIA
serviceboard, telegraph, no. 2, installation 103
- OATMAN, L. E. *illus* 321
- Odd Electrons in Polymer Molecules* (W. O. Baker, F. H. Winslow, W. A. Yager) 480 (referred to)
- OFFICE, central *See* Central Office
- Ohl, R. S.
I.R.E. Fellow 38
p-n junctions, development 241
- Olmstead, Paul S.
Rutgers University honorary appointment 277
- Olsen, Karl M. *illus* 205
biographical material 205
Zone-Melting 201-05
- On the Adsorption of Oxygen on Tungsten as Revealed in the Field Emission Electron Microscope* (J. A. Becker, R. G. Brandes) 330 (referred to)
- On the Consistency of an Axiom of Enumerability* (V. E. Benes) 280 (referred to)

- On the Melting Point of Germanium* (F. X. Hassion, C. D. Thurmond, F. A. Trumbore) 480 (referred to)
- ON-TYPE CARRIER *See* Carrier
- On Webster's Horn Equation* (E. S. Weibel) 330 (referred to)
- OPEN-WIRE LINES
crosstalk 45
interference, reduction 41-45
noise 45
O-type carrier
terminal alarm circuits 109-12
block diagram 110
- OPERATING COMPANIES
outside plant field trials 251-55
- Operation of the Card Translator* (P. Mallery) 93-97
- OPTICAL IMAGE *See* Image
- Optimum Design of Directive Antenna Arrays subject to Random Variations* (E. N. Gilbert, S. P. Morgan) 240 (referred to)
- Orbital Radio Relays (J. R. Pierce) 240, 480 (referred to)
- Order of Magnitude of the Fourier Coefficients in Functions Having Isolated Singularities* (G. Raisbeck) 240 (referred to)
- Ordering Processes in Copper Auride* (F. P. Burns, S. L. Quimby) 280 (referred to)
- Orthogonalized Plane Wave Method* (J. Callaway) 198 (referred to)
- OSCILLATOR
broadband
carrier, L3 coaxial, testing 271-73
56A 271-73; *illus* 272
reflex klystron as 131-32
wide band, voltage-tunable 34
See also Klystron
- OSCILLOGRAPH
rapid record 135
- O-TYPE CARRIER *See* Carrier(s)
- Ouelette, J. R. *illus* 362
- OUTSIDE PLANT
described 251
field trials 251-55
labor costs, reduction 161, 165
- Outside Plant Field Trials* (Miss B. J. Henderson) 251-55
- Overload Control in No. 5 Crossbar* (W. Whitney) 379-81
- OVERTONE CRYSTAL *See* Crystal
- OXYGEN
adsorption, on tungsten 330
electron impact experiments 330

P

- PBX *See* Private Branch Exchange
- PCI SENDER *See* Panel Call Indicator Sender
- PM *See* Phase Modulation
- P1 CARRIER TELEPHONE SYSTEM *See* Carrier
- PANEL CALL INDICATOR SENDER
automatic message accounting, centralized 223-26
CAMA office, role, block diagram 224
- Pape, N. R.
Formation and Properties of Polymer Carbon 320, 480 (referred to)
- PAPERS, published by Members of the Laboratories 34, 71, 119-20, 134, 198, 240, 280, 320, 330, 400, 439, 480
- PARALLEL WIRES *See* Wire
- Partial Model for Quine's 'New Foundations'* (V. E. Benes) 34 (referred to)
- PART(s) *See* Component(s)
- PASCHEN'S LAW
departure from in breakdown of gases 134
- PASSIVE LINEAR NETWORK *See* Linear Network

PATCH CORD

solderless connection 472-73; *illus*

PATCH PLUGS
coaxial

TD-2 radio relay system 450

Patent Law as a Career (N. S. Ewing) 198 (referred to)

PATENT(s), Issued to Members of the Laboratories 40,
79-80, 120, 145, 181, 277, 320, 360, 393, 438, 477

Patterson, R. A. *illus* 37

Pawel, H. E. *illus* 253

PBX Allotter for Number 5 Crossbar (A. C. Mehring)
352-54

Pearson, Gerald L. *illus* 241, 246

Bell Solar Battery 241-46

biographical material 246

*Magneto-Resistance Effect and the Band Structure of
Single Crystal Silicon* 134 (referred to)

Pressure Dependence of the Resistivity of Silicon 330
(referred to)

solar battery, invention 166

solar energy symposium 476

Pederson, D. A.

*Regeneration Analysis of Junction Transistor Multivi-
brators* 400 (referred to)

Pedersen, L.

Aluminum Die Castings for Carrier Telephone Systems
439 (referred to)

Peek, R. L., Jr.

Switching Relay Design, publication 477

Penick, Dixon B. *illus* frontcover Feb. 72, 77

biographical material 77

Carrier Terminals for L3 System 72-77

PERMUTATION(s)

discordant 134

Perreault, G. E.

Development of Reed Switches and Relays 134 (referred
to)

Perry, Jean E. *illus* 16, 18, 20

biographical material 20

Molds Assist the Preservation Treatment of Poles 16-20

PERSONNEL

training, for computing machine field 280

Peters, H.

Hard Rubber 439 (referred to)

Peterson, A. C., Jr.

I.R.E. Professional Group chairman 476

Pfann, William G. *illus* 205

biographical material 38, 205

Continuous Multistage Separation by Zone-Melting 280
(referred to)

*Dislocation Densities in Intersecting Lineage Boundaries
in Germanium* 480 (referred to)

Mathewson Gold Medal, award 38

Radioactive and Photoelectric p-n Junction Power Sources
34 (referred to)

Temperature-Gradient Zone-Melting 439 (referred to)

Zone-Melting 201-05

Pferd, W.

Governor for Telephone Dials—Principles of Design 34
(referred to)

PHASE MODULATION

interference, interchannel, under noise loading conditions
240

PHASE SHIFT

cables, coaxial, at VHF 350-51

PHILADELPHIA ELECTRIC COMPANY

Supervisory Control System, SC1 304-07

Phipps, G. S.

*Experimental Extrusion of Aluminum Cable Sheath at
Bell Telephone Laboratories* 240 (referred to)

PHOSPHORUS

silicon, diffusion into 34

*Photometric Determination of Magnesium in Electronic
Nickel* (Mary E. Campbell, C. L. Luke) 34 (referred
to)

PHOTOTRANSISTOR

cutaway view 218

1N85 445-49; *illus* 446

basic construction 446

current-voltage characteristics 447

junction 445-49

applications, Bell System 449

PHYSICAL SOCIETY

Deddell Medal, awarded to R. Kompfner 151

Physical Theory of Semiconductor Surfaces (W. H. Brattain,
C. G. Garrett) 400 (referred to)

Pierce, John R.

BSIJ Editorial Committee, appointment 371

Director of Research, Electrical Communications 358

General Sources of Noise in Vacuum Tubes 134 (re-
ferred to)

Interaction of Moving Charges with Wave Circuits 280
(referred to)

*Minimum Noise Figure of Traveling-Wave Tubes with
Uniform Helices* 34 (referred to)

National Academy of Science, election 235

Orbital Radio Relays 240, 480 (referred to)

Power Flow in Electron Beam Devices 240 (referred to)

Propagation in Linear Arrays of Parallel Wires 240 (re-
ferred to)

Some Recent Advances in Microwave Tubes 34 (re-
ferred to)

Wave Picture of Microwave Tubes 34 (referred to)

Pin-Hole Camera Inspection of Electron Beams (C. C. Cut-
ler, J. A. Saloom) 198 (referred to)

PLANAR TRIODE *See* Triode

PLANE WAVE *See* Wave

PLASTIC DEFORMATION *See* Deformation

PLASTIC MATERIALS

components, miniature, in 81-84

jack mountings, use 343

terminals, use 343

Plastic Deformation of Germanium and Silicon by Torsion
(E. S. Greiner) 119 (referred to)

PLATING *See* Electroplating

PLUG, patch *See* Patch Plug

P-N JUNCTION *See* Junction

P-N JUNCTION DIODE *See* Diode

P-N JUNCTION SILICON *See* Silicon

P-N-P JUNCTION TRANSISTOR *See* Transistor

POINT-CONTACT DIODE *See* Diode

POINT CONTACT TRANSISTOR *See* Transistor

POINT TYPE BRACKET *See* Bracket

*Polarographic Determination of Phthalic and Anhydride
Alkyd Resins* (P. D. Garn, Mrs. E. W. Halline) 480
(referred to)

POLE(s)

bleeding

defined 455

liquid content, table 456

temperature measurements, precise 455-57

field experiments 16-20

preservation

trichoderma viride 16-20

research project, with American Society for Testing Ma-
terials and United States Forest Products Laboratory
98-99

statistics, Bell System 16

Pollard, C. E. *illus* 63

POLOGONIZED

- POLOGONIZED GERMANIUM** *See* Germanium
odd electrons in molecules of 480
- POLYAMIDE(s)**
resonance, proton magnetic 439
- POLYMER CARBON** *See* Carbon
- POLYTECHNIC INSTITUTE OF BROOKLYN**
centennial 427
Kelly, M. J., honorary degree 427
- POLYTOMIC SIGNALING SYSTEM** *See* Signal
- POLYVINYL CHLORIDE**
applications, Bell System 134
weathering 134
- Poole, K. M.**
Emission from Hollow Cathodes 439 (referred to)
- PORT ANGELES, WASHINGTON**
landing site, Alaska Telephone Cable 358
- PORTLAND, OREGON**
service board, telegraph no. 2, installation 103
- POSITIVE ION** *See* Ion
Positive-Ion Drainage in Magnetically Focused Electron Beams (M. E. Hines, G. W. Hoffman, J. A. Saloom) 439 (referred to)
Potentials of Infinite Systems of Sources and Numerical Solutions of Problems in Semiconductor Engineering (A. Uhler, Jr.) 71 (referred to)
- Potter, J. F.**
Factors Affecting Physical Structure of Dry Pressed Steatite 330 (referred to)
Significant Factors Affecting the Structure of Dry Pressed Steatite 320 (referred to)
- POWER**
p-n junction
radioactive, photoelectric 34
regulation
junction diodes 344-49
junction transistors 344-49
- POWER**
supervisory control system, SC1 304-07
schematic diagram 306
Power Equipment for Telephone Central Offices (C. H. Achenbach) 280 (referred to)
Power Flow in Electron Beam Devices (W. H. Louisell, J. R. Pierce) 240 (referred to)
Power Flow in Electron Beams (L. R. Walker) 400 (referred to)
- POWER RECTIFIER** *See* Rectifier
- POWER SUPPLY**
central offices 280
coaxial carrier, L3 220-22
storage batteries 458-60
Power Supply for the L3 System (H. H. Spencer) 220-22
- PRACTICES, Bell System** *See* Bell System Practices
- Precise Temperature Measurements on Bleeding Poles* (G. Q. Lumsden) 455-57
- Precision Ceramics* (W. F. Janssen) 369-71
- Precision 30-Mc Admittance Bridge* (L. E. Herborn) 21-24
- Prelashing Aerial Telephone Cable* (F. W. Haskell, O. L. Walter) 161-65
- Pressure Dependence of the Resistivity of Silicon* (G. L. Pearson, P. William) 330 (referred to)
- Price, T. Brooke**
retirement 399
- Prince, M. B.**
rectifier, silicon, development 303
Silicon Solar Energy Cells 280 (referred to)
solar energy symposium 476
- Pritchard, G. Curtis** *illus* 187
- PRIVATE BRANCH EXCHANGE**
crossbar systems, 5-type, allotter 352-54
pictorial representation 353
- PROD, test, safety** 213
- Program Switching in TD-2 Radio Relay* (W. O. Fullerton) 415-18
- Propagation in Linear Arrays of Parallel Wires* (J. R. Pierce) 240 (referred to)
- Properties of Junction Transistors* (R. J. Kircher) 400 (referred to)
- Protection of Service in the TD-2 Radio Relay System by Automatic Channel Switching* (H. W. Evans, G. A. Pullis, I. Weber) 240 (referred to)
- Proton Magnetic Resonance in Polyamides* (W. Slichter) 439 (referred to)
- P-TYPE SILICON** *See* Silicon
- Pullis, G. A.**
Protection of Service in the TD-2 Radio Relay System by Automatic Channel Switching 240 (referred to)
- PULSE CIRCUIT** *See* Circuit
- PULSE GENERATOR, regenerative** *See* Generator
- PULSE SWITCHING** *See* Switching
- Pulse-Switching Circuits Using Magnetic Cores* (M. Kar-nauth) 280 (referred to)
- PULSE TRANSMISSION** *See* Transmission
- PUMP**
mercury diffusion
drawing, simplified 2
Purification of Silicon (H. C. Theurer) 327-30
- Purvis, Matthew R.** *illus* 103
biographical material 103
New Telegraph Serviceboard Using Electronic Circuits 198 (referred to)
Service Features of the No. 2 Telegraph Serviceboard 100-03
- PYROHELIOMETER** *illus* 166
- PYROMETER**
fine-wire
development 455
poles, temperature measurement 455-57

Q

- Quarles, Donald A.** *illus* 359
biographical material 359
honorary degree, New York University 235
Secretary of Air Force, appointment 359
- QUARTZ**
alpha
friction, internal 119
moduli, elastic 119
- Queripel, Mrs. P. A.** *illus* 229, 231
- Quimby, S. L.**
Ordering Processes in Copper Auride 280 (referred to)

R

- RMS VALUE** *See* Root Mean Square or Deviation Value
- RADIO**
military
AN/TRC-24 set 382-84
control terminal 263; *illus*
network, communication, with cable 290-93
teletypewriter service 461
- relay systems
microwave
klystrons, reflex 173-77
- TD-2**
antenna, broadband horn reflector 401-04
coaxial patch plugs 450
program switching 415-18
service, protection 240
- TH**
antenna, broadband horn reflector 401-04

- TJ
antenna, broadband horn reflector 401-04
UHF, multichannel 34
orbital 240, 480
transmitter, *see* Transmitter
- RADIO SET
AN/TRC-24 382-84
antenna 466-67
equipment 34
mechanical features 34
- Radio Set AN/TRC-24: Antenna (W. C. Babcock, E. L. LeBright) 466-67
- RADIO TELEPHONE SYSTEM, emergency 365-68
- RADIO TELETYPEWRITER *See* Teletypewriter Facilities
- RADIO TRANSMITTER *See* Transmitter
- Radioactive and Photoelectric p-n Junction Power Sources (W. G. Pfann, W. Van Roosbroeck) 34 (referred to)
- Radley, Sir Gordon *illus* 432
Christopher Columbus International Communication Prize, award 432-33
Transatlantic Telephone Cable 198 (referred to)
- Raisbeck, G.
Definition of Passive Linear Networks in Terms of Time and Energy 120 (referred to)
Order of Magnitude of the Fourier Coefficients in Functions Having Isolated Singularities 240 (referred to)
solar energy symposium 476
- RAPID RECORD OSCILLOGRAPH *See* Oscillograph
- Rate-Grown Germanium Crystals for High-Frequency Transistors (H. E. Bridgers, E. D. Kolb) 429 (referred to)
- Rea, W. T.
A.I.E.E. executive committee number 477
- REACTION SYSTEMS
stagewise
calculation, design method 71
- Read, W. T., Jr.
Scattering of Electrons by Charged Dislocations in Semiconductors 198 (referred to)
Statistics of the Occupation of Dislocation Acceptor Centres 34 (referred to)
- Recent Work on Group III Antimonides and Arsenides (H. J. Hrostowski, M. Tannenbaum) 134 (referred to)
- RECIPROCAL DEVICES 419
- RECIPROCITY
microphone, condenser, W. E. 640 AA calibration *illus* 6
- Reck, Frank *illus* 281, 284
biographical material 284
Combination Wire-Wrapping Tool 281-84
- RECORD
editorial board and staff, *see* inside front covers
- RECORDER, traffic usage 127
- RECORDING SYSTEM
high speed, new 135-36
- RECTIFIER(s)
metallic, regulated
semiconductor devices, applications 119
semiconductors, use 344
silicon, new 303; *illus*
applications, Bell System 303
- Reed, E. D. *illus* 173, 177
biographical material 177
Reflex Klystrons for Microwave Radio Relay Systems 173-77
Tunable, Low-Voltage Reflex Klystron for Operation in the 50- to 60-kmc Band 240 (referred to)
- REED RELAY *See* Relay
- REED SWITCH *See* Switch
- REFLECTOR, horn, antenna *See* Antenna
- REFLEX KLYSTRON *See* Klystron
- Reflex Klystrons for Microwave Radio Relay Systems (E. D. Reed) 173-77
- Regeneration Analysis of Junction Transistor Multivibrators (D. O. Pederson) 400 (referred to)
- Regenerative Pulse Generator (C. C. Cutler) 134 (referred to)
- REGENERATIVE REPEATER *See* Repeater
- REGULATED RECTIFIER *See* Rectifier
- Reinschmidt, C. G. *illus* 430, 431
AN/TRC-24: Radio Transmitter 428-31
biographical material 431
- Reinterpretation of Electron Impact Experiments in Carbon Monoxide, Nitrogen, Nitric Oxide, and Oxygen (H. D. Hagstrum) 330 (referred to)
- Reiss, Howard
Ionization and Solubility in Semiconductors 134 (referred to)
- RELAXATION PHENOMENA
ferrites 320
lead, crystal, attenuation, at low temperatures 330
metals, at low temperatures 320
- Relaxation Phenomena in Ferrites (A. M. Clogston) 320 (referred to)
- Relaxations in the Attenuation of Single Crystal Lead at Low Temperatures and Their Relation to Dislocation Theory (W. P. Mason) 330 (referred to)
- RELAY(s)
adjustment 60
applications, Bell System 355
contacts, *see* Contact
mercury-contact 276
adjustment 60
mercury-contact 291 *illus* 61
adjustment, automatic 60-64
reed, development 134
sealed switch, for AMA 355-57
wire-spring
contact erosion 50-53
- RELAY SYSTEMS *See* Radio
- Remeika, J. P.
crystals, growth 335
New Class of Ferroelectrics 280 (referred to)
- Rentrop, Esther *illus* 49
biographical material 49
Type-O1 Transposition System 41-44
- REPEATER(s)
amplifying in either line direction 120
auxiliary
coaxial system, L3
block diagram 184
coaxial system, L3 182-87
equalizing
coaxial system, L3 184
block diagram 185
- E-type
testing 34
theory 34
- functions
frequency-frogging 26-27
- loop, 96A1
serviceboard, telegraph, no. 2 424-27
schematic diagram 426
- microwave transmitter-receiver combination 131
- O-type carrier 25-29
- regenerative
telegraph transmission 12
- submarine cable
first, completion 116-17
- switching main
coaxial system, L3 185-87

REPEATER

- Repeater Amplifies in Either Line Direction* (J. L. Merrill, Jr., A. F. Rose, J. O. Smethurst) 120 (referred to)
- Repeaters and Group Circuits in Type-O Carrier* (H. T. King) 25-28
- Repeaters in the L3 Coaxial Carrier System* (C. G. Arnold) 182-87
- Repholz, J. M. *illus* 314
- REPORTING SYSTEM, emergency development 359
- RESEARCH *See* Industrial Research
- RESIN(s)
- alkyd, anhydride
 - polarographic determination 480
 - phthalic
 - polarographic determination 480
- RESISTIVITY
- crystals, measurement 308-12
 - semiconductors, measurement 308-12
- RESONANCE
- proton magnetic 439
 - See also* Ferromagnetic Resonance
- RESONANCE, spin *See* Spin Resonance
- Resistivity Changes in Silicon Single Crystals Induced by Heat Treatment* (E. Buehler, J. A. Ditzenberger, C. S. Fuller, N. B. Hannay) 240 (referred to)
- RESONANT CIRCUIT *See* Circuit
- Results of Propagation Tests at 505 Mc and 4,090 Mc on Beyond-Horizon Paths* (K. Bullington, A. L. Durkee, W. J. Inkster) 480 (referred to)
- Review of NBS Circular 526 Optical Image Evaluation* (W. T. Wintringham) 330 (referred to)
- Revised Telephone Transmission Rating Plan* (P. W. Blye, O. H. Coolidge, H. R. Huntley) 240 (referred to)
- Rhodium-Germanium System I* (S. Geller) 134
- RHODIUM SELENIDE *See* Crystal
- Rice, S. O.
- Interchannel Interference in FM and PM Systems under Noise Loading Conditions* 240 (referred to)
- Riesz, R. P. *illus* 108
- Riordan, J.
- Discordant Permutations* 134 (referred to)
- Ritchie, A. E.
- A.I.E.E. executive committee member 477
- Robertson, S. D.
- Ultra-Bandwidth Finline Coupler* 320 (referred to)
- Robinson, Edgar R. *illus* 321, 326
- Automatic Private-Line Teletypewriter Switching System* 321-26
 - biographical material 326
- Robinson, F. N. H.
- Minimum Noise Figure of Microwave Beam Amplifiers* 400 (referred to)
- Rock, Jean *illus* 127
- Rodgers, B. L. *illus* 305
- Rodwin, G.
- New Military Carrier Telephone System* 274-75
- Rogers, Harry S. *illus* 427
- Role of Industrial Research and Development in Society* (M. J. Kelly) 120 (referred to)
- Romnes, H. I. *illus* 433
- A.T.&T. Vice President 433
 - biographical material 433
- ROOT MEAN SQUARE OR DEVIATION VALUE
- telegraph circuits 14
- Rose, A. F.
- Repeater Amplifies in Either Line Direction* 120 (referred to)
- Rose, D. J.
- High-Frequency Gas Discharge Plasma in Hydrogen* 280 (referred to)
- Rosenbaum, P. *illus* 12
- Ross, Ian M. *illus* 167, 172
- biographical material 172
 - Field-Effect Transistor* 167-72
- Rounds, P. W.
- Equalization of Cables for Local Television Transmission* 320 (referred to)
- ROUTING
- automatic, alternate 31
- Rowen, J. H.
- Ferro Magnetism at Microwave Frequencies and Its Applications* 240 (referred to)
 - Measurement of the Complex Tensor Permeability of Ferrites* 34 (referred to)
- RUBBER
- hard 439
- RUBIDIUM FLUORIDE
- cosine interaction 280
- Ruehle, A. E.
- Evaporation of Barium and Strontium from Oxide-Coated Cathode* 134 (referred to)
- Rupp, W. R. *illus* 354
- RURAL TELEPHONE SERVICE
- transmission lines 280
- Ruthroff, C. L. *illus* 133

S

- SC1 SUPERVISORY CONTROL SYSTEM *See* Supervisory Control System
- 6A ANNOUNCEMENT SYSTEM *See* Announcement System
- 640 AA CONDENSER MICROPHONE *See* Microphone
- 680A TRANSFORMER *See* Transformer
- Safer Testing Aids* (J. T. Schott) 212-14
- SAFETY
- Bell System record 212
- SAFETY TEST PROD 213
- Saloom, J. A.
- Pin-Hole Camera Inspection of Electron Beams* 198 (referred to)
 - Positive-Ion Drainage in Magnetically Focused Electron Beams* 439 (referred to)
- Scaff, J. H.
- p-n junctions, development 241
- Scales, Miss E. M.
- Effect of Performance of Tilting the Toll-Operator's Key-set* 120, 198 (referred to)
- Scattering of Electrons by Charged Dislocations in Semiconductors* (W. T. Read, Jr.) 198 (referred to)
- Schafer, J. P. *illus* 385, 389
- biographical material 389
 - Ferrite Isolators at 11,000 Megacycles* 385-89
- Schawlow, A. L.
- Crystal Structure and Quadrupole Coupling of Cyanogen Bromide, BrCN* 320 (referred to)
- SCHEMATIC DRAWINGS
- improved 439
- SCHERING-TYPE BRIDGE *See* Bridge
- Schimpf, L. G. *illus* 123
- Schissler, L. R.
- Boolean Matrices and the Design of Combinational Relay Switching Circuits* 71 (referred to)
- Schneider, Charles *illus* 153, 154
- biographical material 154
 - Stability Evaluation of Switching Apparatus* 153-54
- Schott, J. T. *illus* 214
- biographical material 214
 - Safer Testing Aids* 212-14
- Schramm, C. W.
- New Military Carrier Telephone Systems* 34 (referred to)

- SCHROEDINGER EQUATION**
 error, sources of 439
 model, audio-frequency circuit 439
- Schwartz, M.**
Semiconductor Devices Made with Single Crystal Germanium Silicon Alloys 120 (referred to)
- SCIENCE**
 teaching of, crisis in 34
- SCOTT, JOHN, MEDAL**
 Bardeen, John, award 187
 Brattain, Walter H., award 187
- Scully, W. J. illus** 32
- Sealed Switch Relays for AMA* (O. M. Hovgaard) 355-57
- Search for Double Beta Decay in Calcium 48* (J. A. McCarthy) 240 (referred to)
- SEEBECK EFFECT** 400
 silicon 320
- Seebeck Effect in Silicon* (T. H. Geballe, G. W. Hull) 320 (referred to)
- SELENIUM**
 See also Crystal: rhodium selenide
- Self-Propagating Intermittent Discharge* (W. S. Boyle) 280 (referred to)
- SEMICONDUCTOR(S), SEMICONDUCTING MATERIALS** 330
 contacts 260-63
 crystals
 development 41
 diodes 227-31
 electrons, scattering, by charged dislocations 198
 engineering
 problems, numerical solutions 71
 ionization 134
 lifetime measurements 308-12
 many-valley
 transport properties 134
 power, thermoelectric, theory 120
 power regulation 344-49
 research 327
 resistivity measurements 308-12
 semi-infinite
 injected current carrier transport 280
 solubility 134
 surfaces, physical theory 400
 surface properties 134
- Semiconductor Devices in Regulated Amplifiers* (B. H. Hamilton) 119 (referred to)
- Semiconductor Devices Made with Single Crystal Germanium Silicon Alloys* (A. J. Goss, R. A. Logan, M. Schwartz) 120 (referred to)
- Semiconductor Diodes* (D. K. Wilson) 227-31
- Semiconductors* (W. Shockley) 330 (referred to)
- Semiconductors—Resistivity and Lifetime Measurements* (L. B. Valdes) 308-12
- SEMI-INFINITE SEMICONDUCTORS** See Semiconductor
- SENDER** See Panel Call Indicator Sender
- Sepe, Edmund N. illus** 461, 464, 465
 biographical material 465
- Space Diversity Arrangement for Radio Teletypewriters* 461-65
- Sernelius, W. C.**
Determination of Thermodynamic Equilibrium Constants in Mixed Solvents 34 (referred to)
- Service Features of the No. 2 Telegraph Serviceboard* (M. R. Purvis) 100-03
- SERVICE MAINTENANCE**
 crossbar systems, 5-type
 overload control 379-81
 trouble cards 206-10
 O-type carrier
 testing instructions, improved 299-302
- radio telephone system, emergency 365-68
- SERVICEBOARD**
 telegraph, no. 2
 circuit features 424-27
 functions 100
 installations 103
 service features 100-03
- Servicing Center for Short-Haul Carrier* (A. L. Bonner) 264-66
- SERVO SYSTEMS**
 mechanical
 design 34
- SET, telephone** See Telephone Set
- Shannon, Claude E.**
 Stuart Ballantine Medal, award 436-37
- Shearer, P. H. illus** 227
- SHEATH, cable** See Cable
- Shewhart, Walter A.**
 A.S.M.E. Holley Medal, award 117
- SHIELD, cable** See Cable
- SHIELDING**
 flag-type 59
- SHIFT, phase** See Phase Shift
- Shive, J. N. illus** 449
 biographical material 449
Junction Phototransistors 445-49
- Shockley, William**
 Defense Department post 318
 honorary degree, University of Pennsylvania 318
 I.R.E. Fellow 38
 National Academy of Sciences, membership 235
Semiconductors 330 (referred to)
- SHORT-HAUL CARRIER** See Carrier
- Short-Haul Microwave Transmitter* (L. C. Tillotson) 131-34
- SIGMA TAU**
 Distinguished Service Award to S. Bracken, A. N. Gonsior, W. Wohlenberg 159
- SIGNAL(S), SIGNALING SYSTEMS**
 detection, studies 134
 polytonic, experimental 320
 single-frequency, in-band 34
- SIGNAL CORPS** See United States Army Signal Corps
- Signal-Detection Studies and Their Applications* (E. L. Kaplan) 134 (referred to)
- Significant Factors Affecting the Physical Structure of Dry Pressed Steatite* (J. R. Fisher, J. F. Potter) 320 (referred to)
- SILICA**
 fused, absorption, ultrasonic 240
- SILICA GLASS** See Glass
- SILICON**
 alloys, see Alloy
 boron
 adsorption 34
 determination 34
 carriers, minority, trapping 134
 cells, solar 280
 deformation, plastic, by torsion 119
 donor levels, theory 280
 donor status in
 splitting, hyperfine 34
 donor states, theory 320
 impurities 327
 impurity centers 134
 phosphorus, adsorption 34
 preparation 327
 p-type
 carriers, minority, trapping 134
 p-n junction
 solar battery 166

SILICON

SILICON, continued

- pure
 - preparation 328-30
 - laboratory apparatus, diagram 328
 - tantalum, use 329
 - purification 327-30
 - resistivity
 - pressure dependence 330
 - Seebeck Effect 320
 - semiconductor research 327-30
 - See also Crystal: cobalt silicide; Germanium-Silicon Phase
- SILICON ALLOY DIODE See Diode
- SILICON DIODE See Diode
- Silicon *n-p-n* Grown Junction Transistors (E. Buehler, N. B. Hannay, M. Tannenbaum, L. B. Valdes) 320 (referred to)
- SILICON RECTIFIER See Rectifier
- Silicon Solar Energy Cells (M. B. Prince) 280 (referred to)
- Silsbee, H. B.
 - Cosine Interaction in Cesium Fluoride and Rubidium Fluoride 280 (referred to)
- SILVER
 - irradiation effects near 10° K 198
- SILVER ALLOY See Alloy
- Simple Circuit for Frequency Standards Employing Over-tone Crystals (E. P. Felch, J. O. Israel) 280 (referred to)
- SIMPLEX WIRE AND CABLE COMPANY
 - submarine cable repeaters, armoring 116
- Sims, R. Y. *illus* 314, 316
 - biographical material 316
 - Cama—Sender Test Circuit 313-16
- Singer, F. J.
 - Director of Systems Engineering III 277
- Single-Crystal Germanium (H. E. Bridgers) 41-44
- SINGLE TAPERED MODE COUPLER See Coupler
- Sitte, Kurt
 - Electron Production in High-Energy Nuclear Interactions 120 (referred to)
 - Mean Free Path for Shower Production by High-Energy π Mesons 119 (referred to)
- Skinner, Robert S. *illus* 179, 181
 - A.I.E.E. executive committee member 477
 - biographical material 181
 - Card Translator Equipment 178-81
- Slichter, W. P.
 - Proton Magnetic Resonance in Polyamides 439 (referred to)
- SLIP
 - crystal 285-89
 - germanium 400
- SLOAN, ALFRED P., FOUNDATION
 - M. J. Kelly, trustee 235
 - trustees listed 235
- Small Signal Performance of the 416B Planar Triode between 60-4,000 Megacycles (L. H. Von Ohlsen) 134 (referred to)
- Smethurst, J. O.
 - E-Type Telephone Repeaters—Description, Equipment, and Testing 34 (referred to)
- Smethurst, J. O.
 - Repeater Amplifiers in Either Line Direction 120 (referred to)
- Smith, B.
 - Helium II Film Transport, I—The Role of Substrate 280 (referred to)
 - Helium II Film Transport, II. The Role of Surface Finish 439 (referred to)
 - Helium II Film Transport, III. The Role of Film Height 400 (referred to)
 - Helium II Film Transport, IV. The Role of Temperature 439 (referred to)
- Smith, Kenneth D. *illus* 374, 378
 - biographical material 378
 - Grown Junction Transistor Development 374-78
 - solar battery, further development 166
- Snoke, L. R. *illus* 18, 457
- SOCIETY OF MOTION PICTURE AND TELEVISION ENGINEERS
 - Jensen, A. G., Vice President 476
 - Wintringham, W. T., Fellow 437
- SODIUM FLUORIDE
 - wood preservative 16-20
- Sohnle, G. F. *illus* 267, 270
 - biographical material 270
 - Cama: Transverter and Billing Indexer 267-70
- SOLAR BATTERY 241-46; *illus* 166
 - applications, Bell System 166
 - cell 242: *illus*
 - current, charging 245
 - efficiency doubled 166
 - experimental service 434
 - facts, important, six 243
 - field trial 166, 398, 434
 - inventors 166
 - life expectancy 243, 254
 - operation 434
 - power characteristics 244-45
 - principles 241-42
- SOLAR CELL See Cell
- SOLDERLESS WRAPPED CONNECTION See Connection
- SOLID(s)
 - friction, internal
 - measurement 119
 - moduli, elastic
 - measurement 119
- SOLVENT(s)
 - mixed
 - thermodynamic equilibrium constants 34
- Some Applications of Semiconductor Devices in the Feedback Loop of Regulated Metallic Amplifiers (B. H. Hamilton) 119 (referred to)
- Some Aspects of Slip in Germanium (R. G. Treuting) 400 (referred to)
- Some Current Work at Bell Telephone Laboratories (K. K. Darrow) 330 (referred to)
- Some Gyrator and Impedance Inverter Circuits (B. P. Bogert) 330 (referred to)
- Some Mathematical Aspects of Switching (F. Hohn) 198 (referred to)
- Some New Intermetallic Compounds with the β -Wolfram Structure (S. Geller, R. Goldstein, B. T. Matthias) 240 (referred to)
- Some Recent Advances in Microwave Tubes (J. R. Pierce) 34 (referred to)
- SOUND
 - stereophonic
 - reproduction, enhancement, using Haas Effect 320
- Southard, Ken *illus* 141
- SOUTHERN BELL TELEPHONE AND TELEGRAPH COMPANY
 - Bell Solar Battery, field trial 398
 - 105A wire terminal test *illus* 253
- SOUTHERN PINE
 - preservative treatment 16-20
- Southworth, G. C.
 - The Challenge 198 (referred to)
- Space Diversity Arrangement for Radio Teletypewriters (E. N. Sepe) 461-65
- Spectrochemical Procedure of General Applicability (E. K. Jaycox) 240 (referred to)

SPEECH

measurement

microphone, condenser, W.E. 640 AA 6-10

reproduced by telephone instruments

measurement

microphone, condenser, W.E. 640 AA 6-10

Spelizer, H. H. *illus* 220, 222

biographical material 222

Power Supply for the L3 System 220-22Spencer, Thomas A. *illus* 35, 37

biographical material 37

New Frequency Analyzer 35-37

SPIN RESONANCE

electrons, absorption in metals 280

SPIRAL FOUR CABLE *See* Cable

SPlice(s)

cable

closures, mechanical 400

Splicers and Pads for Coaxial and Balanced-Pair Cables

(F. W. Koller) 472-73

SPOTSYLVANIA, VIRGINIA

outside plant rural line test *illus* 251

SPRING

wiper

switch, 197-type, improvement 372-73

Spring-Type Micro-Balance (M. S. Burgess) 50-53

Sproul, P. T.

A.I.E.E. executive committee member 477

SPURIOUS CURRENT *See* Current

SPUTTERING

high-vacuum

radiation damage theory 280

*Stability Considerations in VHF Point-Contact Transistor**Parameter Measurements* (D. E. Thomas) 34 (re-

ferred to)

Stability Evaluation of Switching Apparatus (C. Schneider) 153-54*Stability of Negative Impedance Elements in Short Trans-**mission Lines* (J. Gammie, J. L. Merrill, Jr.) 134

(referred to)

STAGWISE REACTION SYSTEMS *See* Reaction Systems

Stansbury, E. J.

solar battery, further development 166

*Statistically Designed Experiment of the Factorial Type**Applied to Point-Contact Transistors* (Miss M. Eder,

F. Keene, R. Warner) 240 (referred to)

STATISTICS

experimental

problems, unsolved 280

Statistics of the Occupation of Dislocation Acceptor Centres

(W. T. Read, Jr.) 34 (referred to)

STEATITE

dry, pressed

physical characteristics 330

physical structure 320

STEEL

carbon

transformations 330

STEP-BY-STEP SYSTEM *See* Switching SystemsStephens, W. E. *illus* 52*Stereophonic Sound Reproduction Enhancement Utilizing**the Haas Effect* (B. P. Bogert) 320 (referred to)Stock, Ruth H. *illus* 334

STORAGE BATTERY

applications, Bell System 458-60

characteristics 458-60

charging 459

functions 458-60

life expectancy 459-60

maintenance 459

STORAGE DEVICES

ferroelectric 335-42

Storks, K. H.

Note on Electron Diffraction Patterns of Cupric Oxide

400 (referred to)

Story of Q (E. I. Green) 480 (referred to)Straube, Harold M. *illus* 248, 250

biographical material 250

Miniature Transistor Amplifier 247-50*Strength of Small Metal Specimens* (C. Herring) 285-89

STRONTIUM

evaporation, from oxide-coated cathode 134

tungsten, adsorption on 480

Stuart, D. A.

*Calculation of the Activation Energy of Ionic Conduc-**tivity in Silica Glasses by Classical Methods* 71 (re-

ferred to)

STUART BALLANTINE MEDAL

Shannon, C. E., award 436-37

Sturzenegger, W. C. *illus* 70SUBMARINE CABLE REPEATER *See* Repeater

Suhl, H.

*Ferromagnetic Resonance in Magnesium-Manganese Alu-**minum Ferrite between 160 and 1,900 Mc* 439 (re-

ferred to)

*Ferromagnetic Resonance in Nickel Ferrite between One**and Two Kilomegacycles* 134 (referred to)

SULFUR HEXAFLUORIDE (gas)

corona effect, reduction, coaxial carrier, L3 146-48

dielectric properties 146-48

Sullivan, J. G. *illus* 254

Sullivan, J. W.

Wide Band Voltage Tunable Oscillator 34 (referred to)

SUN

power, source of 241

SUPERCONDUCTIVITY

valence electrons per atom, empirical relation 120

SUPERSONIC JET *See* Jet

SUPERVISORY CONTROL SYSTEM

SC1 304-07

schematic diagram 306

Surface Properties of Semiconductors (W. H. Brattain,

C. G. B. Garrett) 134 (referred to)

Surface Studies with the Electron Microscope (C. J. Cal-

bick) 439 (referred to)

SURFACE WIRING *See* Wiring

SWITCH

197-type

wiper springs, improvement 372-73

223-type, coaxial

network television service 415-18

reed, development 134

sealed, relay 355-57

SWITCHING

automatic channel

TD-2 radio relay system 240

circuit, *see* Circuit

high-speed

transistors, design 320

mathematical aspects 198

pulse

using magnetic cores 280

television, network 415-18

"two-train"

4A crossbar system 394-97

SWITCHING APPARATUS

stability 152-54

SWITCHING CIRCUIT *See* CircuitSWITCHING MAIN REPEATER *See* Repeater

SWITCHING

SWITCHING SYSTEMS

- components, testing 152
- 4A toll
 - applications 31
 - dialing, nationwide, conversion 188-92
- 4M
 - applications, Bell System 31
 - intertoll 30
 - local 30
 - recording system, high speed 135-36
 - relays, use 355
 - step-by-step
 - code conversion by no. 5 crossbar 411
 - tandem 30
 - teletypewriter
 - 81D1 321-26
 - automatic-address unit *illus* 325
 - operation 323-26
 - switching center, schematic diagram 324
- See also Crossbar Systems*
- System Plan for Air Traffic Control Embodying the Cursor-Coordinated Display* (W. O. Arnold, R. R. Hoeffle) 400 (referred to)

T

- TH RADIO RELAY SYSTEM *See* Radio
- TD-2 RADIO RELAY SYSTEM *See* Radio
- TJ RADIO RELAY SYSTEM *See* Radio
- TRADIC *See* Transistor-Digital-Computer
- 10A FREQUENCY ANALYZER *See* Frequency Analyzer
- 208A TERMINAL *See* Terminal
- 210A TERMINAL *See* Terminal
- 223-TYPE COAXIAL SWITCH *See* Switch
- 252A JACK MOUNTING *See* Jack Mounting
- 291 MERCURY-CONTACT RELAY *See* Relay
- 276 MERCURY-CONTACT RELAY *See* Relay
- TALKS, by Members of the Laboratories 39-40, 80, 118-19, 159-60, 199-200, 238-40, 278-79, 318-19, 360, 400, 440, 478-80
- Talpey, T. E.
 - Nature of the Uncorrelated Component of Induced Grid Noise* 240 (referred to)
- TANDEM BRACKET *See* Bracket
- Tannenbaum, M.
 - Recent Work on Group III Antimonides and Arsenides* 134 (referred to)
 - Silicon n-p-n Crown Junction Transistors* 320 (referred to)
- TANTALUM
 - silicon, purification, use 329
- Tapered Velocity Couplers* (J. S. Cook) 320 (referred to)
- Taylor, J. A. *illus* 19
- TELEGRAPH
 - serviceboard, using electronic circuits 198
 - transmission
 - coefficients 11-15
 - coefficient, limiting 13
 - impairments, expression 11
 - limiting error rate 13
- TELEGRAPH SERVICEBOARD *See* Serviceboard
- Telegraph Transmission Coefficients* (S. I. Cory) 11-15
- TELEPHONE *See* Dial Telephone
- Telephone Lines for Rural Subscriber* (L. Hochgraf, R. G. Watling) 280 (referred to)
- TELEPHONE POLE *See* Pole
- TELEPHONE SET
 - 532-type
 - amplifier, schematic diagram 363
 - design 361-63
 - volume control 361-63
- Telephone Switching Network and Its Electronic Control* (S. T. Brewer, G. Hecht) 134 (referred to)
- TELETYPEWRITER(S)
 - service statistics, Bell System 321
 - switching system, *see* Switching Systems
- Teletypewriter Billing of Special Toll Calls* (W. Y. Lang) 232-35
- TELETYPEWRITER FACILITIES
 - expansion, Bell System 424
 - radio
 - space diversity arrangement 461-65
 - relay system, automatic
 - Consolidated Freightways installation 438
 - serviceboard, no. 2, use 100-03
- TELEVISION
 - color
 - differential phase and gain measurements 34
 - operation 480
 - evolution of 34
 - networks, *see* Network
 - off-the-air-pickup, proposed 148
 - transmission, new system 320
 - transmission, local
 - cables, equalization 320
- TELLURIUM
 - See also Rhodium Telluride*
- TEMPERATURE
 - dislocation theory, relation 330
 - poles, bleeding
 - measurement 455-57
- Temperature-Gradient Zone-Melting* (W. G. Pfann) 439 (referred to)
- TERMINAL(S)
 - AN/TCC-3 *illus* 275
- TERMINAL
 - AN/TCC-7 274-75; *illus* 274
 - 208A *illus* 343
 - 210A *illus* 343
 - carrier
 - function 72
 - military radio, control 263
 - wire
 - 105A
 - outside plant test *illus* 253
- TEST SET
 - 5U 264-66
 - characteristics 264
 - schematic diagrams 265, 266
- TESTING
 - clamp, drop wire 70-71
 - L3 coaxial carrier, oscillator 271-73
 - O-type carrier
 - Bell System Practices, improved 299-302; *illus* 300-01
 - outside plant 251-55
 - poles 98-99
 - repeaters
 - E-type 34
 - safety in 212-14
 - switching apparatus 152-54
 - thermal analysis, differential 451-54
- TETRODE TRANSISTOR *See* Transistor
- Thayer, Gordon N. *illus* 475
- A.T.&T. Chief Engineer 475
- biographical material 475
- The Challenge* (G. C. Southworth) 198 (referred to)
- Theory of Donor Levels in Silicon* (W. Kohn, J. M. Luttinger) 280 (referred to)
- Theory of Donor States in Silicon* (W. Kohn, J. M. Luttinger) 320 (referred to)

- Theory of E-Type Repeaters* (J. L. Merrill, Jr.) 34 (referred to)
- Theory of Open-Contact Performance of Twin Contacts* (M. M. Atalla, Miss R. E. Cox) 34 (referred to)
- Theory of the Kinetics of Formation of Anode Films at High Fields* (J. F. Dewald) 134 (referred to)
- Theory of the Thermoelectric Power of Semiconductors* (C. Herring) 120 (referred to)
- THERMAL ANALYSIS**
differential 451-54
- THERMAL NOISE** See Noise
- Thermal Velocity Effects in Electron Guns* (C. C. Cutler, M. E. Hines) 198 (referred to)
- THERMIONIC EMISSION** See Emission
- Thermionic Emission Microscopy of Metals—Part I. General* (R. D. Heidenreich) 320 (referred to)
- Thermionic Emission Microscopy of Metals II—Transformations in Plain Carbon Steels* (R. D. Heidenreich) 330 (referred to)
- THERMOCOUPLE**
fine-wire
details illus 456
- THERMOPHONE**
microphone, condenser, W. E. 640 AA
calibration 10
- Theurer, Henry C. illus 327, 329, frontcover June
biographical material 329
- Purification of Silicon* 327-30
- Thomas, D. E.
Stability Considerations in VHF Point-Contact Transistor Parameter Measurements 34 (referred to)
- Thomason, W. T. illus 338
- Thurmond, C. D.
On the Melting Point of Germanium 480 (referred to)
- Tidd, W. H.
Demonstration of Bandwidth Capabilities of Beyond-Horizon Tropospheric Radio Propagation 480 (referred to)
- Tien, P. K.
Large Signal Theory of Traveling Wave Amplifiers 198, 439 (referred to)
- Tilden, E. F.
Anisotropy and Magnetostriction of Some Ferrites 480 (referred to)
- Tillotson, Leroy C. illus 131, 133
biographical material 133
Short-Haul Microwave Transmitter 131-34
- TIME BUREAUS**
announcements, magnetic 364
"Time of Day" Goes Magnetic (R. F. Massonneau) 364
- TIME-VARIABLE NETWORK** See Network
- TOLL CROSSBAR SYSTEM** See Crossbar Systems
- TOOL**
wire-wrapping, combinational 281-84
operation 282-83 illus
wire-wrapping, conventional 281
- Townsend, M. A.
A.I.E.E. executive committee member 477
- TRAFFIC**
Bell Laboratories work 125-30
crossbar systems, 5-type
PBX allotter 352-54
pictorial representation 353
distribution, studies 127-30
load control
crossbar systems, toll 256-59
studies 125-30
See also Air Traffic
- Traffic Engineering in Bell Telephone Laboratories* (W. O. Turner) 125-30, 140
- Traffic Load Control in Toll Crossbar Systems* (C. H. McCandless) 256-59
- Traffic Registration in 4A Toll Crossbar* (W. J. Meyer, Jr.) 149-51
- TRAFFIC USAGE RECORDER** 127
- TRAINING, personnel**
computing machine field 280
- Training Programs in Industry for Graduate Engineers* (M. J. Kelly) 439 (referred to)
- TRANS WORLD AIRLINES**
81D1 teletypewriter switching system 321-26
map 322
- TRANSATLANTIC TELEPHONE CABLE** 198
cable laying started 298
first cable, completion 414
microwave link, plans 118
repeaters, submerged
first, completion 116-17
- Transatlantic Telephone Cable* (G. W. Gilman, R. J. Halsey, M. J. Kelly, Sir G. Radley) 198 (referred to)
- Transducer Design for Ultrasonic Delay Lines* (H. J. McSkimin) 240 (referred to)
- TRANSFORMER**
680A illus 180
- TRANSISTOR(s)**
applications, Bell System 344
assembly
machine, new 108
capacitor, use with 442
contacts 260-63
crossbar system, 4A applications 215-19
field-effect 167-72
schematic representation 168
(as) amplifier
schematic diagram 172
gate voltage parameter
characteristics, theoretical 171
space-charge region
schematic diagrams 170
- germanium
junction, alloyed
design 320
zone-refining 203
improvement 344
(as) industrial research episode 119
junction
532-type telephone set, design 361
large-signal behavior 34
large-signal transient response 34
n-p-n
development 374-78
rectifier, circuit 345
p-n-p
rectifier, circuit 345
power regulation 344-49
properties 400
pulse circuits, nonsaturating, use 330
junction, alloyed, germanium 320
junction, grown
development 374-78
fabrication, steps, diagram 375
manufacture 71
waterfall analogy 376
- point-contact
factorial experiment, application 240
point-contact, VHF
parameters, measurement
stability considerations 34
silicon, grown junction n-p-n 320

TRANSISTOR

TRANSISTOR, continued

- tetrode 121-24; *illus* 108
- electrical characteristics 123
- evolution *illus* 122
- manufacture 122-23

See also Phototransistor

TRANSISTOR AMPLIFIER *See* Amplifier

Transistor as an Industrial Research Episode (R. Bown) 119 (referred to)

TRANSISTOR-DIGITAL-COMPUTER

development 155-56

Transistors in the 4A Crossbar System (P. Mallery) 215-19

Transition Structure in Lead-Silver Alloys and a Dislocation Mechanism (R. D. Heidenreich) 240 (referred to)

TRANSLATION

- foreign area
- crossbar system, no. 5 54-57

TRANSLATOR

- card
 - crossbar system, 4A toll, function 294-98
 - equipment
 - development 178-81
 - operation 93-97
 - simplified sketch 95, 96
 - specimen cards *illus* 94

Translator Card in Toll Crossbar (D. A. James) 294-98

TRANSMISSION

- circuits, *see* Circuit
- information, digital, over telephone circuits 240
- L3 carrier system
 - equalizers, adjustable 468-71
- microwave
 - klystrons, reflex 173-77
 - over-the-horizon 197-98
 - antenna *illus* 197
- pulse, effect of transmission lines on 198

radio

- over-the-horizon 480
- research, objectives 121
- telegraph
 - circuits 11-12
 - coefficients 11-15
 - coefficients, limiting 13
 - impairments, expression 11
 - limiting error rate 13
- telephone
 - rating plan, revised 240
- television
 - new system 320
 - program switching 415-18
- television, local
 - cables, equalization 320
- rating method 15

Transmission Line Characteristics and Effects on Pulse Transmission (P. Mertz) 198 (referred to)

TRANSMISSION LINES

- characteristics, effects on pulse transmission 198
- rural service 280
- See also* Open-Wire Lines

TRANSMISSION NETWORK *See* Network

Transmission of Digital Information over Telephone Circuits (A. W. Horton, Jr., H. E. Vaughan) 240 (referred to)

TRANSMISSION SYSTEM *See* Carrier

TRANSMITTER

- microwave, klystron
 - simplified schematic 132
- microwave, short-haul 131-34
- radio
 - AN/TRC-24 428-31
 - block diagram 429

Transport Properties of a Many-Valley Semiconductor (C. Herring) 134 (referred to)

TRANSPPOSITION SYSTEM

- design 46
- O1 type 45-49

TRANSVERTER

- automatic message accounting, centralized 267-70
- block diagrams 268

Trapping of Minority Carriers in Silicon. Part I: P-Type Silicon (J. R. Haynes, J. A. Hornbeck) 134 (referred to)

TRAVELING-WAVE AMPLIFIER *See* Amplifier

TRAVELING-WAVE TUBE *See* Electron Tubes

Traveling-Wave Tube Experiments at Millimeter Wavelengths with a New, Easily Built, Space-Harmonic Circuit (A. Karp) 120 (referred to)

Treuting, R. G.

- Some Aspects of Slip in Germanium* 400 (referred to)

TRICHODERMA VIRIDE

- poles, preservation 16-20
- wood preservatives, penetration 16-20

TRIODE

- planar
 - 416B
 - small-signal performance 134

Trumbore, F. A.

- Electrolytic Preparation of Molybdenum from Fused Salts, III* 120 (referred to)

Germanium-Silicon Phase Diagram 480 (referred to)

On the Melting Point of Germanium 480 (referred to)

TRUTH-FUNCTIONAL LOGIC *See* Boolean Algebra

TUBE(s) *See* Electron Tubes

Tukey, J. W.

- Unsolved Problems of Experimental Statistics* 280 (referred to)

Tunable, Low-Voltage Reflex Klystron for Operation in the 50- to 60-kmc Band (E. D. Reed) 240 (referred to)

TUNGSTEN

- barium, adsorption 480
- β -Wolfram structure
 - intermetallic compounds 240
- oxygen, adsorption 330
- emission, thermionic
 - velocity analysis 320
- strontium, adsorption 480

Turner, W. O. *illus* 125, 130

biographical material 130

Traffic Engineering in Bell Telephone Laboratories 125-30, 140

"Two-Train" Switching in Toll Crossbar Offices (J. J. Cozine) 394-97

TYPE-O CARRIER *See* Carrier(s)

Type-O Carrier—Terminal Alarm Circuits (V. J. Hawks) 109-12

Type-O1 Transposition System (Esther Rentrop) 45-49

U

U.R.S.I. *See* International Scientific Radio Union

Uhler, Arthur, Jr.

- Micromachining with Virtual Electrodes* 480 (referred to)

Potentials of Infinite Systems of Sources and Numerical Solutions of Problems in Semiconductor Engineering 71 (referred to)

Ulrich, W.

- Engineering Multistage Diode Logic Circuits* 439 (referred to)

Ultra-Bandwidth Finline Coupler (S. D. Robertson) 320 (referred to)

- Ultra-High Vacua* (J. A. Becker) 1-5
Ultrasonic Absorption in Fused Silica at Low Temperatures and High Frequencies (O. L. Anderson, H. E. Bommel) 240 (referred to)
 ULTRASONIC ATTENUATION *See* Attenuation
Ultrasonic Attenuation in Normal Conducting Lead at Low Temperatures (W. P. Mason) 134 (referred to)
 ULTRASONIC DELAY LINES *See* Delay Lines
 Uminowicz, A. J. *illus* 75, 473
 UNITED STATES AIR FORCE
 Distant Early Warning Line, contract awarded to Western Electric 158
 Missile Test Center cable, acceptance 437-38
 Quarles, Donald A., appointed Secretary 359
 Scientific Advisory Board
 M. J. Kelly, chairman 117
 transistor digital computer 155-56
 UNITED STATES ARMY SIGNAL CORPS
 Alaska Communications System 358
 network, communication, using wire and radio 274-75, 290-93
 UNITED STATES FOREST PRODUCTS LABORATORY
 pole research, with Bell System and American Society for Testing Materials 98-99
 UNITED STATES NAVY
 Office of Naval Research
 Kelly, M. J., elected vice chairman, Naval Research Advisory Board 358
Unsolved Problems of Experimental Statistics (J. W. Tukey) 280 (referred to)

V

- VACUA
 development, history 1-3
 high
 production, mercury diffusion pump 2
 ultra-high 1-5
 currents, spurious 3
 gettering phenomena 4-5
 VACUUM
 connection, coaxial with 280
 high
 breakdown, electrical 320
 VACUUM DIODE *See* Diode
 VACUUM TUBES *See* Electron Tubes
 Valdes, L. B. *illus* 310, 312
 biographical material 312
 Semiconductors—Resistivity and Lifetime Measurements 308-12
 Silicon n-p-n Grown Junction Transistors 320 (referred to)
 Van Roosbroeck, W.
 Injected Current Carrier Transport in a Semi-Infinite Semi-conductor and the Determination of Lifetimes and Surface Recombination Velocities 280 (referred to)
 Radioactive and Photoelectric p-n Junction Power Sources 34 (referred to)
 Van Steamburg, Vincent L. *illus* 223, 225
 Van Uitert, L. G.
 Determination of Thermodynamic Equilibrium Constants in Mixed Solvents 34 (referred to)
 Ferromagnetic Resonance in Magnesium-Manganese Aluminum Ferrite between 160 and 1,900 Mc 439 (referred to)
 VAPOR(s)
 adsorption, on germanium 439
 VARIABLE NETWORK *See* Network

- Vaughan, H. E.
 Control Features of Magnetic-Drum Telephone Office 280 (referred to)
 Transmission of Digital Information over Telephone Circuits 240 (referred to)
Velocity Analysis of Thermionic Emission from Single-Crystal Tungsten (A. R. Hutson) 320 (referred to)
 VIBRATOR
 See also Multivibrator
 VIDEO *See* Television
 Vogel, F. Lincoln, Jr., *illus* 107
 biographical material 107
 Dislocations in Germanium Crystals 104-07
 Dislocations in Low-Angle Boundaries in Germanium 330 (referred to)
 Dislocations in Polygonized Germanium 198 (referred to)
 VOLUME CONTROL TELEPHONE SET *See* Telephone Set
 Von Aulock, W.
 Measurement of the Complex Tensor Permeability of Ferrites 34 (referred to)
 Von Ohlsen, L. H.
 Small Signal Performance of the 416B Planar Triode between 60-4,000 Megacycles 134 (referred to)
Vowel Synthesis by Means of Resonant Circuits (E. S. Weibel) 480 (referred to)

W

- W. E. 640 AA CONDENSER MICROPHONE *See* Microphone
 Wagar, H. N.
 Switching Relay Design, publication 477
 Walker, Joan C. *illus* 323
 Walker, L. R.
 Generalizations of Brillouin Flow 320 (referred to)
 Large Signal Theory of Traveling Wave Amplifiers 439 (referred to)
 Large Signal Theory of Traveling-Wave Amplifiers 198 (referred to)
 Large-Signal Theory of Traveling-Wave Amplifiers 280 (referred to)
 Power Flow in Electron Beams 400 (referred to)
 WALL, domain *See* Domain Wall
 Wallace, R. L., Jr. *illus* 121, 124
 biographical material 124
 I.R.E. Fellow 473
 Junction Tetrode Transistor 121-24
 Wallder, V. T.
 Weathering of Polyvinyl Chloride Wire and Cable Applications 134 (referred to)
 Walter, O. L. *illus* 165
 biographical material 165
 Prelashing Aerial Telephone Cable 161-65
 Waltz, Maynard C. *illus* 260, 262
 biographical material 262
 Electrical Contacts for Transistors and Diodes 260-63
 Warner, A. W.
 Frequency-Aging of High-Frequency Plated Crystal Units 330 (referred to)
 Warner, R.
 Statistically Designed Experiment of the Factorial Type Applied to Point-Contact Transistors 240 (referred to)
 Watling, R. G.
 Telephone Lines for Rural Subscriber 280 (referred to)
 Watson, H. N.
 Grounding of Portable Electric Equipment 240 (referred to)
 WAVE(s)
 coupling, by warped normal modes 320
 plane, method 198
 WAVE CIRCUIT *See* Circuit

WAVE

- Wave Coupling by Warped Normal Modes* (A. G. Fox) 320 (referred to)
- Wave Picture of Microwave Tubes* (J. R. Pierce) 34 (referred to)
- WAVEGUIDE**
- communication medium 34
 - helical
 - long-distance, new 113
 - multimode
 - measurement techniques 280
 - measurement techniques 480
 - See also Coupler
- Waveguide as a Communication Medium* (S. E. Miller) 34 (referred to)
- WEATHER**
- outside plant, testing 251-55
- Weathering of Polyvinyl Chloride Wire and Cable Applications* (J. B. DeCoste, V. T. Wallder) 134 (referred to)
- Weaver, A.
- In-Band Single-Frequency Signaling* 34 (referred to)
- Weber, L. A. *illus* 226
- biographical material 226
 - Cama—Crossbar Tandem PCI Sender* 223-26
- WEBSTER'S HORN EQUATION 330
- Wehe, H. G. *illus* 441, 444
- biographical material 444
 - Miniature Lacquer Film Capacitors* 34 (referred to)
 - Miniature Metallized Lacquer-Film Capacitors* 441-44
- Weibel, E. S.
- On Webster's Horn Equation* 330 (referred to)
 - Vowel Synthesis by Means of Resonant Circuits* 480 (referred to)
- Weigman, W. *illus* 169
- Weir, A. J. *illus* 58, 473
- Weiss, M. T.
- Behavior and Applications of Ferrites in the Microwave Region* 71 (referred to)
 - Behavior of Ferroxdure at Microwave Frequencies* 330 (referred to)
 - Ferromagnetic Resonance in Ferroxdure* 320 (referred to)
- Welber, I.
- Protection of Service in the TD-2 Radio Relay System by Automatic Channel Switching* 240 (referred to)
- Weller, E. *illus* 254
- Wells, H. A. *illus* 70
- Drop Wire Clamp Testing Machine* 70-71
- Westaway, W. T. *illus* 82, 84
- biographical material 84
 - Minaplas—Miniature Apparatus in Plastic* 81-84
- WESTERN ELECTRIC**
- Distant Early Warning Line, prime contractor 158
 - manufacturing, distribution, and installation locations *map* 157
 - Minaplas assemblies, development 81
 - Missile Test Center cable, construction 437-38
 - 1954 year-end report, highlights 156-57
- WHARTON SCHOOL ALUMNI SOCIETY MEDAL
- Craig, Cleo F., award 475
- Wheatley, R. M. *illus* 367
- WHEATSTONE BRIDGE See Bridge
- Whelan, J. M. *illus* 327
- WHISKER(s)**
- crystals, deformation 288
- WHITE PLAINS, NEW YORK**
- 4A switching system, installation 29
- Whitney, Wiley *illus* 379, 381
- biographical material 381
 - Overload Control in No. 5 Crossbar* 379-81

- Why Storage Batteries?* (R. D. deKay) 458-60
- Wick, R. F.
- Ferroelectrics and the Dielectric Amplifier* 34 (referred to)
- WIEDEMANN EFFECT**
- coils, crossed, magnetostrictive coupling, application 439
- Wilkinson, R. I. *illus* 125
- Willis, E. S. *illus* 138, 140
- biographical material 140
 - Filters for Type-O Carrier* 137-40
- Wilson, Donald K. *illus* 227, 231
- biographical material 231
 - Semiconductor Diodes* 227-31
- Wilson, J. J. *illus* 347
- Wintringham, William T.
- Fellow, Society of Motion Picture and Television Engineers 437
 - I.R.E. Technical Committee chairman 477
- WIPER SPRING** See Spring
- WIRE(s)**
- parallel
 - propagation 240
 - wrapping tool, combinational 281-84
 - operation 282-83; *illus*
 - wrapping tool, conventional 281
 - See also Drop Wire; Open-Wire Lines
- WIRE-SPRING RELAY** See Relay
- WIRE TERMINAL** See Terminal
- WIRING**
- cable
 - wrapping tool, combinational operations, sequence 282; *illus*
 - surface
 - wrapping tool, combinational operations, sequence 283; *illus*
- WIRING MACHINE**
- M-4, development 398
- Wohlenberg, Walter *illus* 159
- Sigma Tau Distinguished Service Award 159
- WOLFRAM** See Tungsten
- WOOD**
- temperature, surface measurement 455-57
- WOOD PRESERVATIVES**
- creosote, retention, determination 240
 - penetration, trichoderma virirole, use 16-20
 - sodium fluoride, effects, tabulated 18
- Wooten, L. A.
- Evaporation of Barium and Strontium from Oxide-Coated Cathode* 134 (referred to)
 - Excess Barium Content of Practical Oxide Coated Cathodes and Thermionic Emission* 400 (referred to)
- WORSHIPFUL COMPANY OF CLOCKMAKERS**
- Marrison, W. A., Tompion Gold Medal, award 476
- WRAPPING TOOL** See Tool
- Wylunda, B. J. *illus* 90

Z

- Zimany, E. J. *illus* frontcover Jan
- ZONE-MELTING** 201-05
- separation, multistage, continuous 280
 - temperature gradient 439
- Zone-Melting* (K. M. Olsen, W. G. Pfann) 201-05
- ZONE-REFINING**
- apparatus *illus* 202
 - method 202-03
 - technique, block diagram 202
- Zuk, Paul *illus* 445, 449
- biographical material 449
 - Junction Phototransistors* 445-49